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THE TERTIARY FORMATIONS OF THE CENTRAL REGION OF THE UNITED STATES.

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THE principal Tertiary formations of the region between the Mississippi river and the Sierra Nevada are the following, as mainly determined by Dr. Hayden: The Puerco, the Wasatch, the Bridger, the Uinta, the White River, the Truckee, the Loup Fork and the Equus beds. Several of these are again distinctly subdivided, and in a few instances such divisions have been regarded by authors as of equal importance with those above mentioned; as, for instance, the Green River portion of the Wasatch. But the evidence of vertebrate palæontology is not as yet clearly favorable to further primary subdivision than is indicated by the above names. In the following pages I will briefly describe the character and distribution of these formations.

The general history of the succession of the Tertiary lakes of the interior of the North American continent and their deposits has been developed by the labors of various geologists, prominent among whom must be mentioned Hayden, Newberry and King. It may be synoptically stated as follows:

The Laramie Cretaceous period witnessed a great difference in the topography of the opposite sides of the Rocky Mountain range. To the east were extensive bodies of brackish and nearly fresh water, with limited ocean communication, studded with islands and bordered by forests. On the west side of the range was a broad continent, composed of mostly marine Mesozoic rocks, whose boundaries are not yet well ascertained. Towards the close of the Laramie, the bed of the great eastern sea began to emerge from the waters, and the continent of the western side of the great range descended. The relations of the two regions

were reversed; the east became the continent, and the west became the sea. The latter, receiving the drainage of the surrounding lands, was a body of fresh water, whose connection with the ocean permitted the entrance of a few marine fishes only. This was the great Wasatch lake, whose deposits extend from the upper waters of the Yellowstone far south into New Mexico and Arizona, between the Rocky mountains on the east and the Wasatch range on the west. Its absence from the east side of the former range indicates the continental condition of that area at the time. The only locality where the Wasatch deposits are extensively deposited on the Laramie, is in the region intermediate between the two districts in Wyoming Territory. Here the sediments of the former are seen to have succeeded those of the latter, and to have been coincident with an entire cessation of brackish conditions. Elevations of the continent northward and southward contracted the area of the great Wasatch sea, and perhaps deepened it, for at this time were deposited the fine limestones and silico-calcareous shales of the Green River epoch. There is no evidence that these beds had a greater eastern extension than that of the parent Wasatch lake. King has given distinct names to these ancient lakes. I think it better to pursue the usual course of using for them the names already given to their deposits, as involving less strain on the memory; the more as the number of these lakes is being increased by numerous new discoveries. The only known region which it covered west of the Wasatch range, is represented to-day by the calcareous strata in Central Utah which I have called the Manti beds. The exact equivalency of these is, however, not quite certain. Further contraction reduced this area to perhaps two lake basins, whose deposits now form two isolated tracts in Southern Wyoming, and are known as the Bridger formation. Continued elevation and drainage caused the desiccation of these basins also, leaving only, so far as present knowledge extends, a body of water on the south of the Uinta mountains, in Northeastern Utah. The sediments of this lake form the Uinta formation, which is the latest member of the series now found in the region lying between the Rocky and Wasatch mountains.

About the time that the elevation of the present drainage basin of the Colorado river was completed, a general subsidence of level of the great region east of the Rocky mountains com-

menced. Extensive lakes were formed in the depressions of the Laramie and older beds which formed the surface, which were probably connected over a tract extending from near the Missouri river to Eastern Wyoming and Colorado. Near the same time a similar body of fresh water occupied a large part of what is now Central Oregon and certain areas in Northwestern Nevada, according to King. The sediments now deposited constitute the White River formation, and the faunal distinctions which I have discovered to characterize the eastern and western basins have led me to employ for them the subdivisional names of White River beds for the former and Truckee (King) for the latter. It may have been during the early part of this period, or during the Uinta, that there existed two contemporary bodies of water, separated by a wide interval of territory. One of these extended over a considerable tract in Northern Nevada, and deposited a coal bed near Osino. A formation probably the same, has been found by Professor Condon in Central Oregon, underlying the Truckee Miocene beds. The other lake left its sediments near Florissant, in the south park of Colorado. This formation I have named the Amyzon beds,[1] from a characteristic genus of fishes which is found in it. It has been referred to the Green River formation by King, but in contradiction to the present palæontological evidence, as it appears to me.

The oscillations of the surface which brought the White River period to a close, are not well understood. Suffice it to say here, that after an interval of time another series of lakes was formed, which have left their deposits at intervals over a wider extent of the continent than have those of any other epoch. These constitute the beds of the Loup Fork period, which are found at many points between the Sierra Nevada and the Rocky mountains, from Oregon to New Mexico, and over parts of the Great Plains of Colorado, Kansas, and northward, and in the valleys of the Rocky mountains. King has shown that the beds of this epoch are slightly elevated to the westward, thus proving that the elevation of the Rocky mountains had not entirely ceased at that late day. A probably continuous succession of lakes has existed from this period to the present time in ever-diminishing numbers. The most important of these later lakes were in the Great basin in Oregon, in Washington and in Nebraska, and their

[1] AMERICAN NATURALIST, May, 1879.

deposits enclose the remains of a fauna entirely distinct from that of the Loup Fork period and of more modern character. They are known as the Equus beds. This fauna was probably contemporaneous with that which roamed through the forests of the eastern portion of the continent, whose remains are inclosed in the deposits of the caves excavated from the ancient limestones.

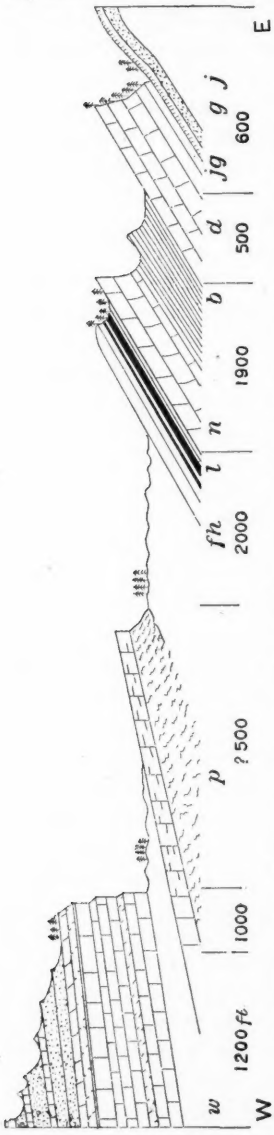

FIG. 2.—Section west of the Gallinas mountains, New Mexico, from Gallinas creek to the Eocene plateau. Letter *j*, Jurassic; *jg*, Jurassic gypsum; *g*, Gallinas creek; *d*, Dakota; *b*, Benton; *n*, Niobrara; *l*, lignite; *fh*, Fox hills, *p*, Puerco; *w*, Wasatch; from Lt. Wheeler's report.

A more detailed account of the formations is now given, with the names of a few of the characteristic fossils.

THE PUERCO.

This formation, having furnished numerous mammalian fossils, is known to belong to the Tertiary rather than the Post-cretaceous series. It is regarded by Dr. Endlich as a subdivision of the Wasatch, but the characteristics of its fauna are so marked as to constitute it a distinct horizon.

The most southern locality at which it has been observed, the one from which I named it, and where its characters are distinctly displayed, is west of the Jemez and Nacimiento mountains, in New Mexico, at the sources of the Puerco river. At this place its outcrop is about 500 feet in thickness, and has an extent of several miles on both sides of the river. From this point the strike is northward, keeping at the distance of a few miles to the eastward of an escarpment of the Wasatch formation. It contracts in depth to

the northward, and it extends to the south-west, beyond the overlying Wasatch beds.

It is well developed in Southern Colorado, where Dr. F. M. Endlich[1] and William H. Holmes,[2] of Dr. Hayden's Survey, detected it in 1876. Its mineral character is there similar to that seen in New Mexico, and its thickness is much greater. On the Animas river it is 1000 to 1200 feet; on the San Juan river, near the Great Hog Back, 700 feet. The general characters of the formation are expressed in the following description, extracted from my report to Lieut. G. M. Wheeler.[3]

"South of the boundary of the Wasatch, the varied green and gray marls formed the material of the country, forming bad land tracts of considerable extent and utter barrenness. They formed conical hills and flat meadows, intersected by deep arroyos, whose perpendicular walls constituted a great impediment to our progress. During the days of my examination of the region, heavy showers of rain fell, filling the arroyos with rushing torrents, and displaying a peculiar character of this marl when wet. It became slippery, resembling soap in consistence, so that the hills were climbed with difficulty, and on the levels the horses' feet sank at every step. The material is so easily transported that the drain-

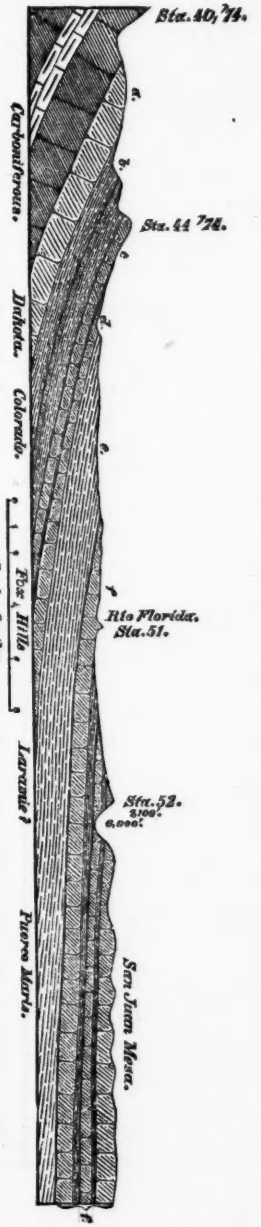

FIG. 3.—Section near the borders of Colorado and New Mexico; from Dr. Hayden.

[1] Annual Report U. S. Geol. Surv. Terrs., 1875, p. 189.

[2] Loc cit., 247.

[3] Annual Report of Chief of Engineers, 1875, p. 89. Appendix 44.

age channels are cut to a great depth, and the Puerco river becomes the receptacle of great quantities of slimy looking mud. Its unctuous appearance resembles strongly soft soap, hence the name *Puerco*, greasy. These soft marls cover a belt of some miles in width, and continue at the foot of another line of sandstone bluffs, which bound the immediate valley of the Puerco to a point eighteen miles below Nacimiento.

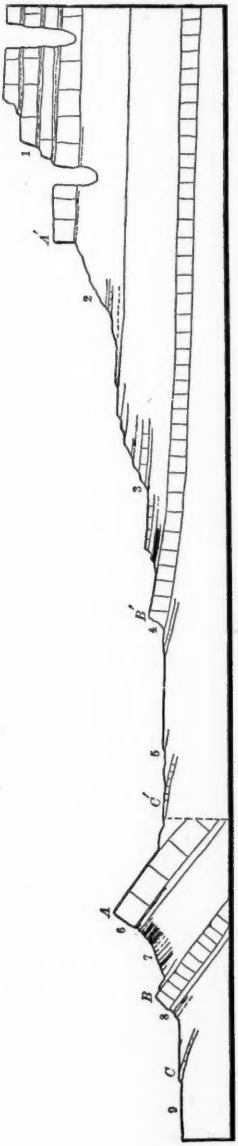

FIG. 4.—Section in southern Colorado, showing apparent duplication of strata and location of the supposed fault, by which *A* would be the same as *A'*, *B* the same as *B'*, and *C* the same as *C'*. Figures are the same as in Fig. 5; from Dr. Hayden's ann. report.

"The Puerco marls have their principal development at this locality. I examined them throughout the forty miles of cutcrop which I observed for fossil remains, but succeeded in finding nothing but fossil wood. This is abundant in the region of the Gallinas, and includes silicified fragments of dicotyledonous and palm trees. On the Puerco, portions of trunks and limbs are strewn on the hills and ravines, in some localities the mass of fragments indicating the place where some large tree had broken up. At one point east of the river I found the stump of a dicotyledonous tree which measured five feet in diameter."

The fauna of this formation is different from that of the other Eocenes in the presence of a saurian, *Champsosaurus*, which is characteristic of the Laramie Cretaceous, and a marsupial Mammal *(Ptilodus)* which is a remnant of a type only known otherwise from the Jurassic. Its characteristic genera are *Catathlæus*, a many-toed hoofed animal, *Psittacotherium*, a gnawing Tillodont, and various flesh-eaters with primitive teeth. *Coryphodon* is, so far, unknown.

THE WASATCH.

In lithological character, the Wasatch consists of a mixed arenaceo-calcareous marl, alternating with beds of white or rusty sandstone. The more massive beds of sandstone are in New Mexico, Colorado and Wyoming, at the base of the formation. The marls readily weather into the fantastic forms and cañon labyrinths of bad-land scenery. The marls often contain concretionary masses of a highly silicious limestone, which cover the banks and slopes of the bluffs with thousands of angular fragments. It is characteristic of this formation that the marls contain brightly colored, usually red strata; and in many localities the colors are various, giving the escarpments a brilliantly banded appearance.

Petrographically this formation has two divisions, the Wasatch proper and the Green River beds; the latter name having sometimes been given to the entire formation as well as the former.

Of the few vertebrate fossils known from the Green River division, some are identical with those of the Wasatch, while at least one genus of fishes is common to the Bridger.

The Wasatch beds proper are much more widely distributed than those of the Green River. They appear first in the south in Northwestern New Mexico, and extend thence into the adjacent parts of Colorado. They are exposed over extensive areas of Colorado west of the Rocky mountains, and reappear in Southwestern Wyoming. They extend along the western portion of the Green River valley, whose northern portion they entirely occupy. On the eastern side of the Wind River mountains it has, according to Hayden, an exposure of from one to five miles in width for a distance of one hundred miles, from the source of the Wind river to the Sweet Water river. North of this point it fills the extensive basin of the Big Horn river to the borders of Montana. It does not occur east of the Rocky Mountain range. The thicknesses given by geologists are the following:

Northwestern New Mexico (Cope).

	Feet.
Red-striped marls	1500
Reddish-brown sandstone	1000
	2500

Rio San Juan, Colorado (Holmes).

Coarse yellowish sandstones, alternating with variegated marls.. 1200

White and Yampa Reservations (Endlich and White).

Chiefly yellow and reddish sandstones, alternating with shales ... 1500

Bear River, Wyoming (Hayden).

Red banded marls	700
Sandstones and shales	800
	1500

Wind River Valley (Hayden).

Variegated marls and sandstones	5000

The Green River division of the Wasatch is much less extensively distributed than the Wasatch proper. Its exposures are confined to the valley of Green river, particularly the regions between its affluents both north and south of the Uinta mountains. In the Bridger basin it forms a wide rim around the Bridger formation, and is especially developed on Fontanelle creek and on Bitter creek, and the region to the south of it. I here found its thickness to be 1200 feet.[1] Farther south, in Western Colorado near the Yampa river, Dr. White gives its depth at 1400 feet.[2] South of this, in Western Colorado, Dr. A. C. Peale[3] gives the united thickness of this formation and the Wasatch at 7670 feet; but how much of this is to be referred to the Green River proper we are not informed. It does not appear to exist on the San Juan, according to Endlich and Holmes, and I did not find it in New Mexico.

According to King, the deposits of the Green River formation rest unconformably on those of the Wasatch.[4] He also believes that it has a considerable extent west of the Wasatch mountains, over parts of Utah and Nevada. I have shown that the palæontological evidence is opposed to the identification of these "Amyzon" beds with the Green River, and that they are probably of later origin. There is, however, a series of calcareous and silico-calcareous beds in Central Utah, in Sevier and San Pete counties, which contain the remains of different species of vertebrates from those which have been derived from either the Green River or *Amyzon* beds. These are *Crocodilus* sp., *Clastes* sp., and a fish provisionally referred to *Priscacara* under the name of *P. testudinaria*. There is nothing to determine to which of the Eocenes this formations should be referred,

[1] Annual Report U. S. Geol. Surv., 1873, pp. 436, 437.
[2] Annual Report U. S. Geol. Surv., 1876, p. 36.
[3] Annual Report, 1874, p. 156.
[4] U. . Survey of the Fortieth Parallel, I, p. 377.

but it is tolerably certain that it is to be distinguished from the

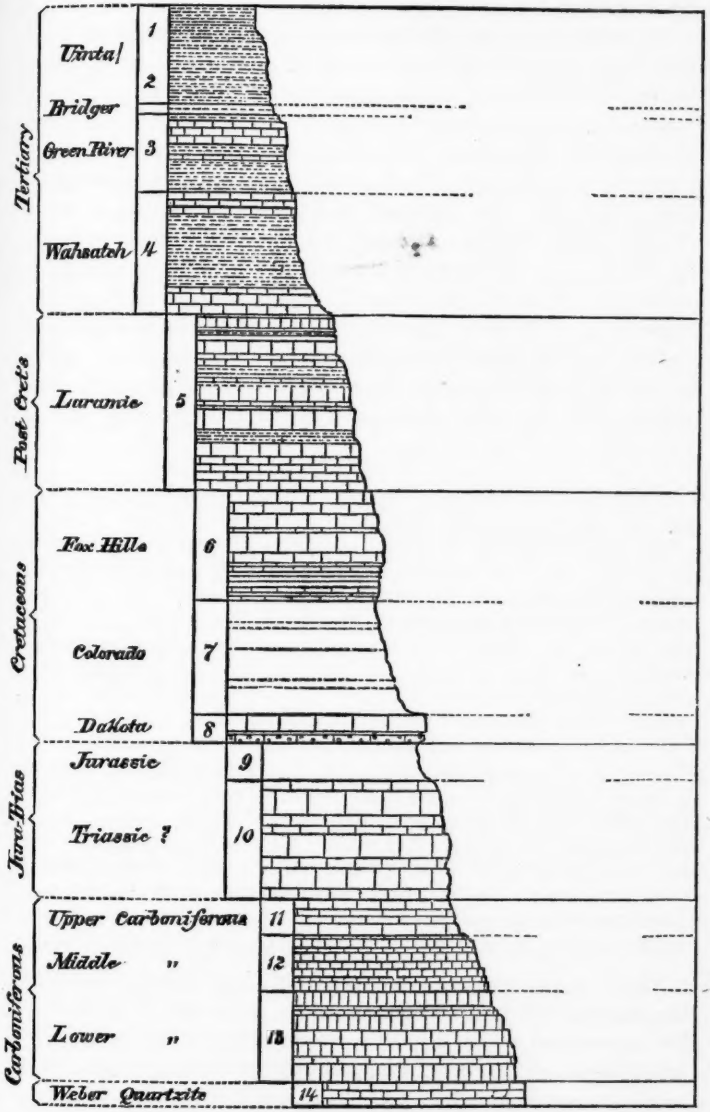

FIG. 5.—General section in the Yampa district.

Amyzon beds. In its petrographic characters it is most like the Green River.[1]

The writer first referred the Wasatch to the Eocene division of the Tertiary, it having been previously regarded as Miocene. (Proceedings American Philosophical Society, February, 1872.)

The vertebrate fauna of the Wasatch is rich, and presents many peculiarities. Prominent among these is the presence of the strange *Coryphodontidæ*, which reached a great development at this time. Also the *Phenacodontidæ*, and the genus *Hyracotherium*. These are the ancestral types of the hoofed mammals, and they were associated with numerous flesh-eaters of partly marsupial character. It is nearly identical with that of the Suessonian of Western Europe, which is at the base of the Eocene series. The fullest account of it is that which I have given in the Report of Captain Wheeler of Explorations and Surveys west of the 100th meridian, Vol. IV.

THE BRIDGER.

"This is one of the more important of the groups among those that, in Western North America, are referred to the Tertiary period, especially as regards the vertebrate remains that have been obtained from its strata. It is most fully and characteristically developed in the region known as the Green River basin, north of the Uinta mountains, only the south-eastern portion of the formation, so far as is now known, extending into Northwestern Colorado. In its typical localities it is found resting conformably upon the Green River group, into which it passes without a distinct plane of demarkation among the strata.

"Its molluscan fossil remains correspond closely with those of the Green River group, some of the species being common to both, all indicating a purely fresh condition of the waters in which the strata of both groups were deposited. At the typical localities the group is composed in great part of soft, variegated, badland sandstones, a peculiar greenish color often predominating over the others, which are reddish, purple, bluish and gray. Limestone strata, marly and clayey beds, and cherty layers are not uncommon, and grits and gravelly layers sometimes occur."

To the above general remarks of Dr. C. A. White I add, that the material of this formation consists of indurated clays more or less arenaceous, which display various degrees of hardness. The harder beds are, however, thin, and the intervening strata yield readily to meteoric influences. They are frequently quite arena-

[1] See AMERICAN NATURALIST, April, 1880.

ceous, and rather thin beds of conglomerate are not uncommon. The colors that predominate are greenish-gray and brownish-green, with frequent ash-colored beds. The peculiar condition of hardness of most of the strata, render it one of the formations which most generally present the bad-land scenery; it permits the erosive action of the elements without general breaking down, great numbers of fragments of the strata remaining in spaces between the lines of destructive action. The result is the extraordinary scenery of Black's Fork, Church Buttes and Mammoth Buttes, of which mention has been made in various recent publications.

The distribution of the Bridger formation is limited, and is, so far as I am aware, restricted to three areas, whose mutual connection is as yet uncertain. Its principal mass is in the Bridger basin, which extends from the northern base of the Uinta mountains to the latitude of the mouth of the Big Sandy river northward. In this area it reaches a depth, according to King, of 2000 or 2500 feet. A second district is also in Wyoming, and lies east of Green river, between Bitter creek and the northern boundary of Colorado, in what is called by King the Washakie basin. The depth of the formation there reaches 1200 feet.[1] The third region is in Western Colorado, where it loses much of its importance. Dr. C. A. White found it only 100 feet in thickness near the White river.[2] Dr. Peale found it near the Gunnison river, as he discovered vertebræ of *Pappichthys*, a genus which belongs to this horizon only; but he did not distinguish it from the underlying formations, so that I do not know its thickness at that point. South of this locality it is unknown.

As pointed out by Leidy, this period is especially characterized by a peculiar and rich vertebrate fauna. This is of truly Eocene character, as I first showed, but it is distinguished from the Wasatch by various subordinate peculiarities. These are the presence of Dinocerata, and of the leading Perissodactyle genera, *Palæosyops* and *Hyrachyus*, together with the absence of many types, as *Coryphodon*, *Tæniodonta*, etc.

THE UINTA.

"Resting directly, but by unconformity of sequence, upon all the Tertiary and Cretaceous groups in the region surrounding the

[1] Annual Report U. S. Geol. Surv. Terrs., 1873 (1874), pp. 436–437.

[2] Annual Report, 1876, p. 36.

Annual Report U. S. Geol. Surv. Terrs., 1874, pp. 157, 158.

eastern end of the Uinta Mountain range is another Tertiary group that has received the name of "Uinta group" from Mr. King, and "Brown's Park group" from Major Powell. It is possible that this group was deposited continuously, at least in part, with the Bridger group, but at the places where the junction between the two groups has been seen in this region, there is an evident unconformity, both of displacement and erosion.

"The group consists of fine and coarse sandstones, with frequent layers of gravel, and occasionally both cherty and calcareous layers occur. The sandstones are sometimes firm and regularly bedded, and sometimes soft and partaking of the character of bad-land material. The color varies from gray to dull reddish-brown, the former prevailing north of the Uinta mountains and the latter south of them.

"The only invertebrate fossils that are known to have been discovered in the strata of this group are some specimens of a *Physa*, very like a recent species. Therefore, invertebrate palæontology has furnished no evidence of its assumed Tertiary age and lacustrine conditions of its deposition. Its fresh-water origin, however, seems unquestionable, because of its intra-continental position, its limited extent, and the fact that none but fresh-water deposits are known in this part of the continent that are of later date than the close of the Laramie period."

To these remarks of Dr. White I add, that several species of *Vertebrata* have been obtained from this formation by Professor Marsh, who has determined from it a few genera of Tertiary and Upper Eocene character. Such are, of *Mesodonta*, the genus *Hyopsodus* and of *Ungulata*, the Perissodactyle form *Amynodon*.

THE WHITE RIVER.

The material of which the beds of this formation are composed in their eastern division, are calcareous clays and marls, alternating with a few unimportant strata of light-colored sandstone. They are white and gray, with occasionally a pink and red, and sometimes greenish tinges. The beds of the western deposit in Oregon, consist of a more or less indurated mud, which is, according to King, of trachytic origin, which is rarely hard, and frequently rather soft. Its predominating color is light green, but is frequently olive and light brown. The depth of the formation on the White river of Nebraska is, according to Hayden,[1] about 150 feet; and on Crow creek, Colorado according to King,[2] 300 feet. Sixty miles east of Crow creek I estimate its thickness as some-

[1] Proceedings Academy, Philada., 1857, p. 153.

[2] Report of Geol. Survey of 40th Parallel, I, 410.

FIG. 6.—Scene in the Bad Lands of the White River formation, in Nebraska. From Dr. Hayden.

what greater. The Truckee beds of Oregon have, according to Marsh, a depth of from 3000 to 4000 feet, and King estimates the deposit exposed in the Hawsoh mountains, Nevada, at 2300 feet.[1] An extensive deposit exposed in the region of the Cajon pass, Southern California, is suspected, by King, to belong to the same horizon.

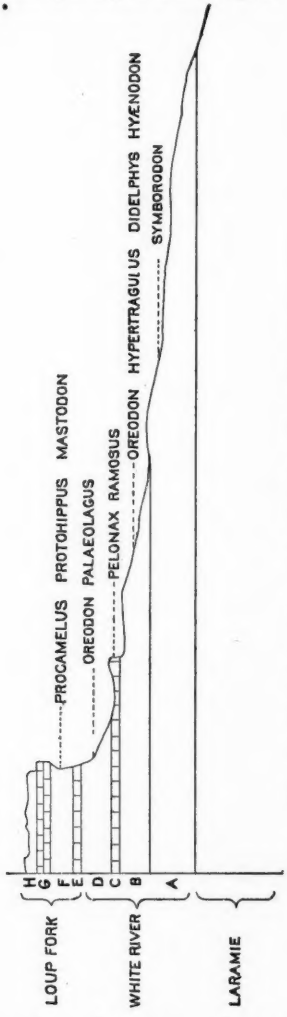

FIG 7.—N. and S. section on Horse-Tail creek, Northeastern Colorado.

The fauna of this epoch is widely different from that of the Eocene in its more modern characteristics. These are the presence of various types of Rodentia, of true Carnivora, of Dicotylidæ, *Elotherium*, *Oreodontidæ*, *Poëbrotherium* and *Rhinocerontidæ*. All the especially Eocene groups are absent, except *Leptictidæ* and a few *Hyænodontidæ*. These give it a more ancient character than the Miocenes generally, so that it is frequently referred to as "Oligocene."

The following diagram represents without much detail, the section in Eastern Colorado, along the Horse Tail creek, from the Chalk bluffs southward.

At both localities the lower beds carry the bones of the gigantic *Menodontidæ*, *Menodus* in Nebraska, and *Symborodon* with *Menodus* in Colorado. But few other types occur in this bed in Colorado, the great number of genera and species being found in bed B, in which I did not discover any fragments of *Chalicotheriidæ* among a large

[1] L. c. p. 423; l. c., p. 415.

quantity of remains of *Ungulata*, *Carnivora*, *Rodentia*, etc. The lithology is as follows: Bed A is a white calcareous soft clay rock, breaking into angular fragments. Bed B has a similar mineral character, with frequently a red color of different obscure shades. Bed C is a sandstone of varying persistence. Bed D is a white argillaceous rock like that of bed A. Fossils are less numerous than in bed B, and included no *Symborodons* nor other *Menodontidæ*.

The eastern area of this formation is the true White River epoch of Hayden; the western deposits form the Truckee epoch of King. I named this formation the Oregon, but Mr. King's name is the older and must be retained.[1]

According to Professor Condon, the Truckee formation of Oregon, on the John Day river, rests unconformably on the laminated beds, containing *Toxodium* and fish remains, which, as I have suggested on a previous page, may be an extension of the Amyzon shales. These in turn rest on a formation of hard laminated beds, which contain an abundance of *Calamites*, which doubtless belong to the Triassic or Jurassic period. The Truckee beds are, like the true White River, overlaid by the Loup Fork, and this in turn by heavy beds of basalt.

The fauna of the Truckee presents some characters which distinguish it from that of the White River. These are, the absence of *Hyænodon*, *Leptictidæ* and *Ischyromys*, and most of the *Menodontidæ*, and the presence of several genera of *Canidæ*, *Nimravidæ* and *Rodentia*. Many genera, and apparently several species, were common to the two epochs.

THE LOUP FORK.

This formation has now been studied in many widely-separated localities in the region west of the Mississippi river. It was discovered by Dr. Hayden, whose collections furnished the basis of Dr. Leidy's determination in 1858.[2] It was next observed by myself in Colorado in 1873,[3] and twenty-one species were determined; and in the following year I identified the Santa Fé marls of New Mexico, already observed by Dr. Hayden, with the same

[1] Bulletin U. S. Geol. Surv. Terrs., v, p. 52.

[2] See Proc. Acad. Nat. Sci. Phila., 1858, p. 20, and Extinct Mammalia of Dakota and Nebraska.

[3] Bulletin of the U. S. Geol. Surv. Terrs., No. 1, Jan., 1874.

horizon.[1] Messrs. Hayden and King have discovered it west of the Wasatch range in Utah and Nevada, and Marsh has observed it in Oregon. Messrs. Dana and Grinnell found it occupying the valley of Deep river in Montana, and Professor Mudge any myself have seen it in Northern and Western Kansas. There is a near lithological resemblance between the strata at these localities, and the fauna presents a common character as distinguished from those which preceded and followed it; but sufficient care has not always been exercised to distinguish its upper members from the *Equus* beds above them. The latter contain a distinct fauna.[2]

According to King, about 1500 feet of beds are included in this formation.

The water-shed between the South Platte river and the Lodge Pole creek, Colorado, is composed superficially of formations of the Loup Fork epoch, of Hayden. On its southern side is an abrupt descent in the level of the country, which generally presents the character of a line of bluffs varying from 200 to 900 feet in height. This line bends to the eastward, and extends in a nearly east and west direction for at least sixty miles.

The upper portion of this line of bluffs and buttes is composed of the Loup Fork sandstone in alternating strata of harder and softer consistency. It is usually of medium hardness, and such beds, where exposed, on both the Lodge Pole and South Platte slopes of the water-shed, appear to be penetrated by numerous tortuous friable silicious rods and stem-like bodies. They resemble the roots of the vegetation of a swamp, and such they may have been, as the stratum is frequently filled with remains of animals which have been buried while it was in a soft state. No better preserved remains of plants were seen.

This formation rests on a stratum of white friable argillaceous rock of the White River epoch, as represented in Fig. 7.

The lithological characters above described are precisely those presented by the same formation in New Mexico.[3]

Mr. King employs the name Niobrara for this formation, but Dr. Hayden's name[4] was introduced many years previously. The

[1] Ann. Rep. Chief of Engineers, 1874, II, p. 603.

[2] See Bulletin U. S. Geol. Surv. Terrs., IV, p. 389, and V, p. 47.

[3] See Report Lieut. G. M. Wheeler's Explorations west of 100th Meridian, Vol, IV, p. 283.

[4] See Dana's Manual of Geology, edit. 1864, p. 511.

new name has also the disadvantage of being already in use for a horizon of the Cretaceous, which is well distinguished palæontologically.

Some genera of Rodentia are common to this formation and the White River *(Steneofiber, Palæolagus)*, but its fauna is well distinguished by the presence of *Camelidæ* with a cannon bone, three-toed horses with cementum in the molars, Antelope with a burr of the horns *(Cosoryx)* and *Mastodon.*

I have divided the Loup River formation into two divisions on palæontological grounds,[1] under the names of the *Ticholeptus* bed, and the *Procamelus* bed. The former occurs in the valley of Deep river, Montana, on the White river in Northern Nebraska, and in Western Nebraska, where it has been found by Mr. Hill. Its fauna presents, in Montana, a mixture of fossils of the *Procamelus* horizon; while in Nebraska, according to Hayden, its typical genera are accompanied by White river Mammalia. In the former region, *Hippotherium, Protohippus* and *Blastomeryx* are mingled with genera allied to *Leptauchenia* and with *Merycochœrus.* In Nebraska, *Leptauchenia* is said to be accompanied by *Ischyromys, Palæolagus, Hyracodon* and even *Oreodon*, genera which do not extend to the *Procamelus* bed. There is, however, a question in my mind whether this collocation is entirely correct. It is bed D of Hayden's section in Leidy's Extinct Fauna, Dakota and Nebraska, p. 20.

The material of the *Ticholeptus* horizon is a more or less friable argillaceous sand; not so coarse and gritty as the *Procamelus* bed, nor so calcareo-argillaceous as the White River.

The *Procamelus* bed is extensively distributed. It is found in Kansas, Nebraska, Colorado, New Mexico, Utah, Nevada and Oregon.

THE EQUUS BEDS.

I can give little information respecting the depth and stratigraphy of the beds of this period as they occur on the plains west of the Mississippi river, for although sections of them as they occur in Nebraska and elsewhere have doubtless been published by authors, their palæontological status has not been determined for the localities described. My own knowledge of the deposits is based on localities in California and Oregon. In Nebraska they have probably been confounded with the Loup Fork beds. They

[1] Bull. U. S. Geol. Surv. Terrs., v, pp. 50–52.

represent the latest of all the Tertiary lakes, and include a fauna which consists of a mixture of extinct and living species, with a few extinct genera.

I have received fossils of this age from Idaho, Washington, Oregon and California. The most important locality in Central Oregon is from thirty to forty miles east of Silver lake.[1] The depth of the formation is unknown, but it is probably not great. It consists, first, of loose sand above, which is moved and piled into dunes by the wind; second, of a soft clay bed a few inches in thickness; third, by a bed of sand of one or two feet in depth; then a bed of clay mixed with sand of unknown depth. The middle bed of sand is fossiliferous. In Northern and Middle California the formation is chiefly gravel, and reaches a depth, in

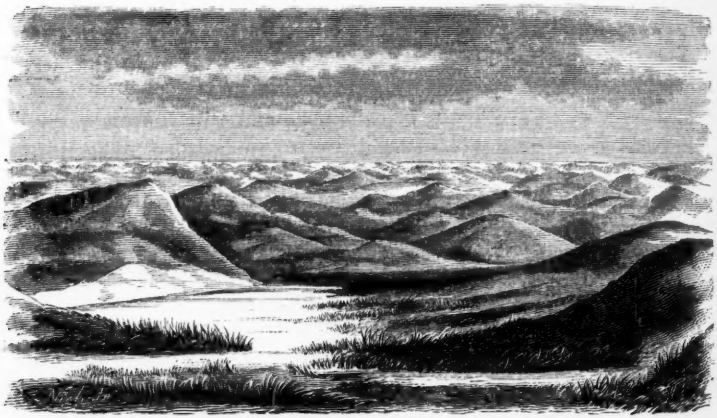

FIG. 8.—Sand hills, Northwestern Nebraska, from Hayden.

some localities, of several hundred feet. Here, as has been proven by Whitney, it contains human remains, associated with *Mastodon*, *Equus*, *Auchenia*, etc. I have obtained *Mylodon* from the same gravel.

Traces of this fauna are found over the Eastern United States, and occur in deposits in the caverns excavated in the Lower Silurian and Carboniferous limestones, wherever the conditions are suitable. This deposit is a red or orange calcareous mud, varied with strata of stalagmite and gypsum. Remains of the fauna are found in clay deposits along several of the Atlantic rivers, as the Delaware and Potomac.

[1] See AMERICAN NATURALIST, 1878, p. 125.

It is probable that the formation in the western localities mentioned is mostly sand. Near Carson City, Nevada, it consists of a light-buff friable calcareous sandstone.

This is the Upper Pliocene of King and the Post-pliocene of various writers.

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A PATHOGENIC SCHIZOPHYTE OF THE HOG.[1]

BY PROFESSOR H. J. DETMERS.

ABOUT twenty-five years ago Professors Brauell and Pollender in Dorpat, Russia, made an important discovery, which, though at first not considered as of much significance, soon led to investigations, the results of which have already revolutionized the ætiology of contagious and infectious diseases. Brauell and Pollender, and soon afterwards also Dr. Leisering in Dresden, discovered in the blood of man and beast, affected with anthrax or splenic fever, an infinite number of exceedingly fine, apparently solid, almost transparent, straight and motionless, rod-shaped bodies (cf. Virchow's Archiv. für Pathol., Anat. und Physiol., und für Klinische Medicin, XI, 2). They called them *staebchenfoermige Koerper* (Bacilli), but left it undecided whether the same bear a casual connection with the morbid process, constitute a product of the same, or are merely accidental. Still, finding these Bacilli in every fatal case of anthrax, Brauell and Pollender considered their presence as something characteristic, and as of great diagnostic and prognostic value. As early as 1860 the relation of these Bacilli to anthrax formed a topic of discussion in the annual meeting of the Veterinary Society of the Grand Duchy of Oldenburg. Later investigations, but especially those by Davaine, Koch, Cohn, Pasteur, Toussaint, and more recently by Dr. Hans Buchner, in Munich, have demonstrated beyond a doubt that these Bacilli, first discovered by Brauell and Pollender of the Imperial Veterinary School of Russia at Dorpat, and first known as Brauell and Pollender's *staebchenfoermige Koerper*, constitute the real and sole cause, and also the infectious principle, of that terrible disease known as anthrax or *Milzbrand* to the Germans, charbon to the French, and anthrax or splenic fever to the English. About the same time, or soon after Brauell and Pollender published their discovery, other simi-

[1] Read before the Chicago Academy of Sciences.

lar microscopic bodies were found, not only in the blood and morbid products in contagious diseases, but also in a great many other things, particularly in putrefying, decomposing, and fermenting substances, in pus, secretions of wounds, in the mucus of the mouth, etc. All this, however, is well known, and as I do not intend to give a history of the discoveries in regard to these minute bodies, comprehended under the generic name of Schizophytes, nor dwell upon the investigations made by many European and some American scientists for the purpose of ascertaining the true character and the relation of those Schizophytes to contagious and so-called zymotic diseases, I will only make one further remark, and then briefly relate what I have seen and ascertained myself. I mentioned the discovery of Brauell and Pollender as a fit introduction to what I shall have to say, and also for the purpose of correcting certain erroneous statements in American literature, which ascribe the first discovery of *Bacillus anthracis* to Davaine, and to other French investigators. For a long time it remained a puzzling question how certain Schizophytes, found in certain diseases in the blood, exudations, and other animal fluids, etc., can constitute the cause and infectious principle of those diseases, while other Schizophytes, apparently identical, or at least very similar in appearance, and of almost universal occurrence, are known to be perfectly harmless. To illustrate, it will only be necessary to mention the great similarity between *Bacillus anthracis* and *Bacillus subtilis*, two of the best known Schizophytes. This question has been solved by the researches of Dr. Hans Buchner in Munich (cf. his monography "Ueber de Experimentelle Erzeugung des Milzbrand Contagiums aus den Heupilzen, und ueber die Entstehung des Milzbrandes durch Einathmung, Muenchen, 1880"). Dr. Buchner, by repeated and continued cultivations in solutions of meat extract, with and without an addition of peptone and sugar, succeeded in converting *Bacillus anthracis* into *Bacillus subtilis;* 36 generations made the former harmless, and about 1500 generations converted the same into a veritable hay-bacillus or *Bacillus subtilis.* Vice versa, by continued and repeated cultivations in fresh blood Dr. Buchner also succeeded in changing a harmless *Bacillus subtilis* into an exceedingly malignant *Bacillus anthracis*, which, introduced into the organism of a healthy animal by inoculation, in every instance caused sure and speedy

death. But as all this is on record, published in works and periodicals just as accessible to my readers as to myself, or perhaps more so, as my present residence is in a country town, I shall not dwell upon it any longer.

It is now fourteen years ago, when so-called Texas fever was decimating the cattle in Central Illinois, the peculiarities of that disease, the characteristic morbid changes, the long period of incubation, and particularly the manner in which the disease was said to be communicated by Texas cattle to native animals, led me to think that some microscopic organism, endowed with life and power of propagation, and subject to changes and metamorphoses, must constitute the cause and the means of infection. I communicated my views to the Hon. John P. Reynolds, then Secretary of the Illinois State Board of Agriculture, and now Chief Grain Inspector of Chicago. My communication, written in very poor English, and coming from an unknown person living in a country town in Northern Illinois, was published in two Chicago papers, but did not procure me an opportunity to make an investigation. Still, even if it had, the investigation, very likely, would not have resulted in anything. In the first place, I had neither the means to procure, nor the necessary experience to use, a first-class microscope, and moreover doubt whether, at that time, fourteen years ago, an instrument was in existence in America that could have successfully coped with the question. Our first-class homogeneous immersion objectives were not known then. My suggestions to Hon. John P. Reynolds, whether known or unknown to them, I do not know, were partially carried out, or acted upon, by Professor Gamgee and his associates, and by the Commissioners of the State of New York (cf. New York Agricultural Report of 1867), but no satisfactory results were obtained. The New York Commissioners even went so far as to send some bile to Professor Hallier in Jena, who, of course, found and cultivated a great variety of fungi, and left the whole thing in a more confused state than it ever was. At any rate, the whole investigation, as far as the ætiology of Texas fever is concerned, did not throw much light upon the subject.

A little over three years ago I was requested by the late Commissioner of Agriculture, Hon. Wm. G. Le Duc, to investigate a very fatal disease of swine, known to the farmers as hog cholera, and from the reports of the Department of Agriculture as swine

plague. I procured a No. 8 Hartnack stand, with three eye-pieces and three Hartnack objectives, a 1 inch, a ¼ inch, and a four-system ⅛ inch, with correction and immersion. Of course, such an instrument was not at all what was needed, but it was the best I could get, and, to tell the truth, the best I was then able to handle. It soon revealed the presence of microscopic organisms —Schizophytes, or, if preferred, Microbes or Bacteria—in the morbid products of the disease, and in the blood of the diseased and dead animals, but its definition and its magnifying power, about 800 diameters, were not sufficient to show the characteristics of the Schizophytes, and to distinguish the same under all circumstances from other bacteria similar in size. Consequently I made several, under the circumstances excusable, errors. If the light happened to be very good and well adjusted, a micrococcus chain appeared as a moniliform rod, and if the light was not very good, as I am sorry to say was very often the case, a Micrococcus chain could not be distinguished from a rod-shaped Bacterium or a Bacillus. All this was very much of a drawback; still I became soon convinced that in the morbid products of the disease and in the blood of the diseased and dead hogs, I had to deal with a specific Schizophyte, which does not occur in the blood, etc., of other animals not affected with swine plague, and is entirely different from *Bacterium termo*, because I observed whenever putrefaction set in, and *Bacterium termo* made its appearance, my swine plague Schizophytes commenced to disappear, and disappeared in about the same ratio in which *Bacterium termo* increased in numbers. Being unfortunately not sufficiently familiar with the classification of Schizophytes, and the distinguishing characteristics of micrococci, bacteria, bacilli, etc., as laid down by Cohn and others, the inadequacy of my microscope caused me to commit a blunder, for which I have to apologize. Professor Klein in England, in his investigation of swine plague, also found a Schizophyte, which he called a "*Bacillus*." Not knowing then, as I do now, that his bacillus, seen with better instruments than that at my command, was an intruder, and not at home where found, and having no doubt whatever that he had seen the identical Schizophyte which I saw and found in every case of swine plague, I proposed the name *Bacillus suis*. As soon as Cohn's classification of Schizophytes fell into my hands I saw my mistake, and endeavored to

correct the same in my next report to the Commissioner of Agriculture, two years ago, in as plain language as I can command; but not knowing at that time the spuriousness of Professor Klein's bacillus, I did not say anything about it. Still, a colaborer—it will not be necessary to give his name—does not appear to be satisfied, misconstrues my language, and yet insists that I call the swine-plague Schizophyte a *Bacillus suis*. But enough of this. It widely differs from a bacillus as defined by Cohn. One of its most characteristic features consists in its forming zoögloea-masses or coccoglia, which, according to Cohn, a bacillus never does. It also does not form straight and motionless rods, nor is its effect directly poisoning, or causing decomposition, like that of *Bacillus anthracis*, but mostly, if not entirely, brought about in a mechanical way, by its mere presence, and by a withdrawal from the animal organism of such elements as are needed for its existence, its metamorphoses, and its propagation. To put it in a few words, it acts like a veritable parasite. I discarded the name Bacillus as soon as I discovered my mistake, and have simply called it Swine-plague Schizophyte or Swine-plague Microbe, leaving it to others, better versed in the classification of Schizophytes, to give it an appropriate name.

About two years ago I obtained the means, a large Beck's stand and a Tolles' $\frac{1}{10}$ homogeneous immersion objective, which enabled me not only to make a more thorough investigation, but also to distinguish, as to shape, form, size, and undergoing-changes, the swine-plague Schizophytes from other Schizophytes classed under the various heads of Micrococci, Bacteria and Bacilli, and particularly from those which invariably make their appearance in all animal fluids and tissues when putrefaction or decomposition is setting in. Still, the amplification to be obtained by eyepiecing without any loss of definition—about 925 to 1000 diameters—proved to be insufficient. Certain characteristics, which I had reason to suppose are existing, and of which I could obtain only occasional glimpses, could not be seen, or were to be seen only in an imperfect manner. I therefore requested Mr. Tolles to make for my special work an objective which, if possible, would give as good and sharp definition with an amplification of 1500 diameters as the $\frac{1}{10}$ in my possession with 925. Mr. Tolles has nobly responded, and it is but just to say that the objective he made, nominally a $\frac{1}{15}$, but in reality close up to a $\frac{1}{17}$, is not only equal,

but in some respects even superior to a magnificent $\frac{1}{18}$ homogeneous immersion objective of Zeiss, which I was fortunate enough to procure last spring. It, the Zeiss objective, is a trifle higher than a $\frac{1}{20}$. These two objectives, the $\frac{1}{15}$ Tolles, and the $\frac{1}{18}$ Zeiss, have been almost exclusively used during the last year. The $\frac{1}{15}$ of Tolles gives, with the No. 2 eyepiece, according to length of tube and collar correction, from 1356 to 1525 diameters.

The Swine-plague Schizophytes present themselves in three, and probably in four, or even five, different forms. As to the three different forms I am certain, as to the fourth and possibly fifth I will not be so positive. The form to begin with is that of a very minute spherical body, a micrococcus of 0. 7 to 0. 8 μ in diameter. It is invariably present in the blood and blood serum, in all morbid products and exudations, and in such morbid tissues as can be conveniently examined with high power objectives

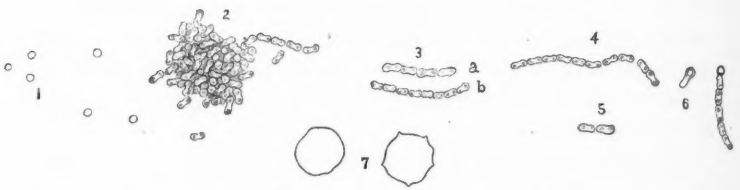

FIG. 1.—1, Swine-plague Micrococci; 2, do. Coccoglia; 3, do. Micrococcus-chain —*b*, five minutes later than *a*; 4, do. do. parting; 5, do. do. pasted joint with flagellum; 6, Helobacteria with lasting spore; 7, blood corpuscles. × 1525 objective: Tolles' $\frac{1}{15}$ homog. immersion.

while fresh. It probably is not necessary to state that the micrococci of Swine-plague, being spherical, do not present any characteristic difference from other micrococci, occurring in other substances, if the latter happen to be of about the same size as the former. Still, differences can be observed, if the micrococci are kept under the microscope for some time—a few hours—at a suitable temperature. The Swine-plague micrococci soon form zoöglœa-masses or aggregate in clusters and become imbedded in an apparently viscous substance. While thus imbedded they soon commence to duplicate by growing in two opposite directions, and at the same time becoming contracted in the middle. This contraction gradually becomes plainer and plainer, and increases in the same degree in which the micrococcus is growing in length, till finally the latter presents the

appearance of two closely connected spherical bodies without any visible partition, and somewhat resembles the shape of a figure 8. At this stage the now bispherical micrococcus is about twice as long as its transverse diameter, or measures about 1.5 μ. In the interior of each spherical body a somewhat darker substance, or a kind of a nucleus can be observed. This duplication, or process of division, which occurs in a large number of micrococci at the same time, it seems, finally breaks the glia, or the viscous mass, which apparently holds the micrococcus cluster together; the micrococci, many, or perhaps most of them now bispherical, and some yet single, become free and make their exit. Whether the glia constitutes the pabulum needed to effect this growth and duplication, and is gradually consumed, or whether the same only serves to hold the micrococci together, and breaks because its contents become too large or too voluminous, I am

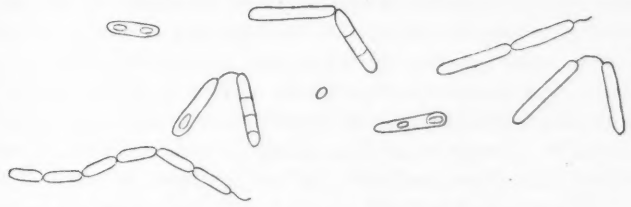

FIG. 2.—Schizophytes (Bacilli) found in the blood of the vena cava posterior of a cow which died of Texan fever. × 925 objective: Tolles' duplex $\frac{1}{16}$ homog. immersion.

not able to decide. These zoöglœa-masses occur and can be found, though seldom in large numbers, in the fresh blood and blood serum; and are very numerous, and often very large in the morbid tissues, the exudations, particularly the lung exudations, and blood extravasations, and in the morbid products in general. I never found them absent. The bispherical, and also the single micrococci, when freed from their glia, do not cease to multiply by fission; on the contrary, the process of division proceeds with great rapidity, provided the temperature is not too low. At an ordinary temperature, say about 70° to 75°, a double or bispherical micrococcus is often changed into a small chain of two double micrococci, connected endways, in less than 5 minutes. While the process of division is thus going on, and the single cells of such a bispherical micrococcus are becoming double by a longitudinal growth, and becoming contracted in the middle, the orig-

inal contraction between the secondary cells also gradually increases and becomes deeper, till it finally appears like a separation, and then the end walls of both cells appear to be closed; the connecting neck cannot be seen, and the cells, now two bispherical micrococci, seem to merely touch each other. The single micrococci, too, become double or bispherical, and those already double gradually increase to chains of various length, and not dissimilar in appearance to a chain of an old-fashioned watch. These micrococcus-chains I consider as the third form spoken of. The same, however, hold together only temporarily, or for a short time, and then break up into larger or smaller joints, each joint consisting of one or more bispherical micrococci. When these chains separate or break up, the separation is not a sudden nor a rapid one; on the contrary, the bispherical micrococci which are about to separate appear to become at first more loosely connected with the rest of the chain; do not seem to be in as close a contact with the adjoining portion as before; a small space between them becomes visible; still there is evidently yet a connection, because the movement of the separating joints, although apparently independent, are limited to a swinging to and fro. The space, however, gradually widens, till finally a separation takes place, and each link or joint goes its way. If the light is very good and well adjusted, and the human eye in first-rate condition, an objective like my Tolles' $\frac{1}{16}$ or Zeiss' $\frac{1}{18}$ will reveal the existence of an exceedingly slender thread, a flagellum, which, gradually lengthening and finally snapping apart, constituted the connecting link or medium between the separating joints. I have repeatedly seen it as a post-flagellum when the joint or bispherical micrococcus was slowly moving, but so far have never seen one at both ends. It may here be remarked, I have never seen any single micrococci separating from such a chain or its joints, consequently the single or spherical micrococci must have another source or origin; but there is little hope that the latter will ever be fully revealed, unless our makers of objectives—men like Tolles, Zeiss, Powell and Leland, and others—will succeed in producing objectives which will give as good and sharp definitions, with an amplification of 2500 or 3000 diameters, as their best ones now in existence are giving with 1200 or 1500 diameters. Still, there is a multitude of other much larger Schizophytes, and concerning them our present means are about suffi-

cient to observe what cannot be seen in regard to the very minute swine-plague Schizophytes. Therefore, a little more than what is really known about the latter may almost safely be inferred from analogy. But I will not enter into speculations, and, at any rate, first state what I have seen. Sometimes in perfectly fresh blood serum and in fresh lung-exudation, and almost always in blood serum and lung-exudation 12 to 24 hours old, and also in the mucus and morbid products of a diseased piece of intestine, peculiar-shaped Schizophytes can be found. The same are rod-shaped, but have at one end, or sometimes towards the middle, a very bright granule, which strongly refracts the light, and consequently is more dense than the rest of the bacterium. It is of about the same diameter as the rod itself. This granule is surrounded or enveloped by a zone or ring—possibly a membrane—which is less dense, and much less light-refracting. The whole rod, therefore, if this granule is situated at one end, as is usually the case, presents the shape of a club, or rather that of a short stick with a bright round knob at one end. It is a so-called Helobacterium (Billroth), and the bright and dense or light-refracting granule is a so-called lasting spore (Dauerspore of Billroth).

(To be continued.)

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ON CERTAIN ABORIGINAL IMPLEMENTS FROM NAPA COUNTY, CALIFORNIA.[1]

BY ROBERT E. C. STEARNS.

THE figures herewith presented illustrate a collection made by me in October, 1881, on the top of Howell mountain, in Napa county.

The mortars are exteriorly rude unworked stones, generally of much harder quality than most of the country rock in the neighborhood. Fig. 1 is the most symmetrical of the five specimens collected; in this respect it is the least characteristic; otherwise so far as diameter and depth of the concavity are considered, it is a fair type of all.

I was unable to find a single specimen, or even a fragment,

[1] Read before the California Academy of Sciences, October 19, 1881.

where the exterior had been shaped. The cavities in all of the

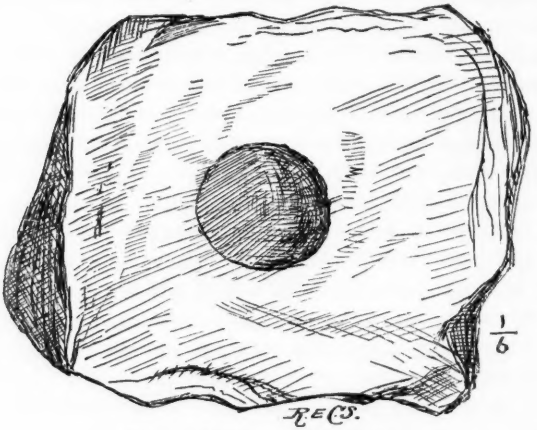


FIG. 1.—California Indian Mortar.

specimens are nearly alike, about four inches in diameter and of the depth of a small saucer.

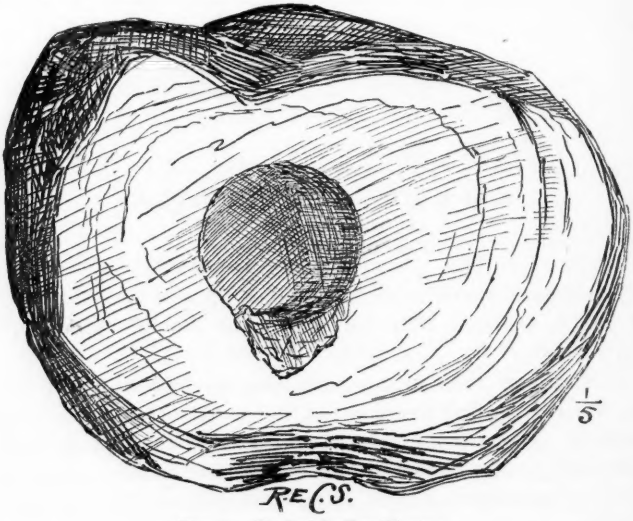


FIG. 2.—Typical Indian Mortar.

The foregoing figure (2) is a fairly typical specimen of this class of mortars. It was found in nearly the same locality as the subject of the preceding figure.

It is not probable that such shallow mortars were used for the pulverization of acorns or pine-nuts, or any other of the principal articles which constituted the bulk of the aboriginal cuisine. This supposition is further supported by the fact of the great number of mortar holes which may be seen in the outcroppings of the permanent or fixed rocks in the immediate neighborhood.

The territory from which the material under review was obtained, embraces an area of some two hundred acres; for the greater part a fertile intervale or small valley surrounded by hilly ground which merges by moderately inclined or gentle slopes into the general level. This intervale is about a mile in length, if measured between the extreme points, though probably not one-fourth of a mile in width at the widest place. When the present owner purchased it, it was for the most part a willow swale about midway of its length; where on the easterly side the slope descends to the intervale, are several perpetual, running springs of most excellent water. These springs are only a few rods apart. In convenient proximity outcroppings of volcanic pudding-stone occur, which are full of mortar-holes of various sizes, from four inches in diameter and depth to twelve inches in diameter and depth. None of the mortar-holes in the fixed rocks are as shallow as those in the portable mortars figured above from which we may infer that these latter were used for some special rather than for general purposes, perhaps for the grinding of paint or medicine, while the fixed mortars were used for general purposes like the pounding of acorns, nuts, &c., &c. Of these latter it is often the case that the larger holes are united at the top and for an inch or more down, through close proximity and abrasion, through constant use the intervening wall or side at the top breaking through. As the springs are more numerous and better situated at this middle station, which by way of distinction may be called station A, so also are the mortar holes more numerous, though the latter are also met with at or near the extreme points or ends of the intervale, which runs in a general way northerly and southerly. The northerly point may be indicated as station B, and the southerly as station C.

Pestles were collected at all of these stations. Some are hardly more than symmetrical cobble-stones, while others are of the usual pestle-form. None of them are nicely finished, and like the mortars are exceedingly simple and rude.

The nearness of the outcropping country-rock to the springs and to the chief articles of food, operated, quite likely, to prevent that degree of development in stone working which is found in such implements among the relics of nearly related and geographically approximate tribes.

There was no imperative necessity, nor anything to be gained by the careful and laborious finishing of portable mortars where the material requiring trituration was abundant and close at hand, making a permanent settlement possible, where otherwise only a temporary camp could be made, dependent for duration upon the extent of the mast or nut-harvest or acorn-crop.

The mortars herewith figured, with, as before remarked, only the capacity of a common saucer, are in stones which weigh from *thirty* to *fifty pounds*. If these had belonged to a tribe within whose domain the acorn and nut-bearing trees were widely scattered, and thereby compelled to be more roving in their habits than the tribe which inhabited the region herein described, the mortars would probably have been smaller in bulk and consequently lighter in weight. To perpetrate a hibernicism, a *portable* acorn mortar of corresponding size and weight as related to capacity, *would not be portable*. Where the food conditions are as above indicated, the mill would of necessity have to be carried to the grist, instead of the grist to the mill; this would compel the carrying of pulverizing implements, and lead not only to a reduction in the weight of such utensils, through finishing the exterior by cutting away every superfluous pound of stone, but also to the careful selection of pieces of stones or cobbles of a more compact and solid quality, so as to combine the greatest strength with the least weight.

This also explains why mortars and pestles are so frequently met with in places near which the evidences of an aboriginal camp or settlement do not exist.

That the tribe which inhabited this Howell mountain locality were not as expert in this class of stone working as those even of the not distant Calistoga and Knight's valley region, the Ash-o-chi-mis, or Wattos, is proven by the mortars collected by me at the last named place in August, 1879; for though the lot of half a dozen included one specimen hollowed in a rough stone, of the same general type as those figured in this paper, it also embraced specimens worked in well selected cobbles, and one hollowed in end of a section of a basaltic column. This latter as well as the

rough-stone one of the Knight's valley collection, are in the Museum of the University of California.

Obsidian in pieces and chips are abundant at each of the stations, though more so at A than the others. The number of arrow-heads, and fragments of arrow-heads, collected principally at A, numbered about two hundred, of which one-third were found by my companion, Mr. A. L. Roach, of Indianapolis. A few were obtained by other parties. With occasional exceptions, the arrow-heads were in the rough stage of manufacture, awaiting critical selection and finishing by experts in this line, probably the veteran Nimrods of the tribe.

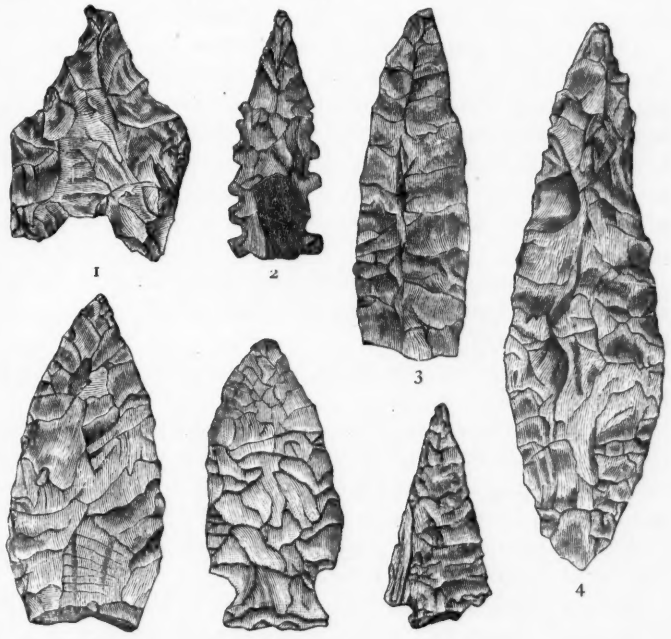


FIG. 3.—Arrow-heads of Obsidian, California.

Obsidian appears to have been the only material used by the ancient arrow-makers of this region; none other was detected among the débris or remains of their long abandoned workshops.

On the opposite side of Napa valley, in a hill not far from the town of St. Helena, obsidian is found in great abundance, and it is probable that from that locality the supply was obtained. About one-third of the arrow-heads were found at station B; the forms of these are shown in the above figures.

Of number one but two specimens were found; number two is another exceedingly rare form, of which the specimen figured is the most perfect, only three or four fragments of this, in addition to that figured, were detected. Mr. Roach obtained a single specimen rather more complete than the above. This form, which is scarcely met with in most California collections, presents the very highest skill in arrow-making art. Number three is perhaps the most abundant form, while four, five and six are numerous; seven is also seldom met with, and is very delicately and nicely worked.

A single bead was detected by Mr. Roach at station C. At this southerly station the mortar (Fig. 1) was found.

The general region herein referred to must have been a paradise to the red man, so far as his needs and aboriginal comfort are concerned. Acorns of several species of oaks, pine nuts, hazel nuts and manzanita berries were probably as abundant in former times as now, and it is altogether probable that game of all kinds was far more abundant than at the present day; in fact all of the requisites for the sustentation of a numerous aboriginal population.

If the community which existed here was at all possessed of æsthetic perceptions, the scenery must have added largely to the other attractions of the place.

As to the particular tribe which constituted that community, I have been unable to learn.

Since this mountain valley became the property of the present owner, I was informed by his wife, that a few years ago there came along, one day, an old Indian, who told her that when he was a boy he lived here with his tribe, and he had now come back to see once again the place where his childhood was passed. "He went up and away over the hills."

Stephen Powers,[1] in his "Contributions to North American Ethnology," places this region within the geographical area of the Wintuns, one of the great groups of Northern Californian Indians, which included numerous tribes. I would particularly call the attention of all interested in this line of inquiry, to this important and interesting volume.

The nearest adjacent tribes were the Napas, the Caymuses, the Calajomanas, the Mayacomas, the Ulucas and the Mutistals.[2]

[1] U. S. Geog. and Geol. Survey, Powell, Vol. III, text and map.

[2] Bancroft's Native Races of the Pacific States, Vol. I, p. 363.

Howell mountain as well as the country beyond, known as Pope's valley, form a region full of attractions for the lover of nature, whether a devotee of science or art. The mountain has an elevation variously stated at from 1500 to 1800 feet above the sea; from favorable points a magnificent panorama is presented, extending to Mt. Diablo in the south, and covering the whole valley of Napa and the westerly mountain ranges which fence in the pleasant valleys between their ridges. The atmosphere is full of health, and the scenery full of inspiration. On every hand, at every turn of the road, right or left, are pictures full of beauty, refreshing to the soul and delightful to the eye. Towering pines, often two hundred feet in height, the Douglass spruce, full of grace and beauty when young, and standing grim, valiant and erect with outstretched and sometimes naked arms when old—as if prepared to wrestle with the storm; sturdy madronas with broadly buttressed bases holding firm to earth, with clean-barked branches widespreading to the sky; noble oaks whose port and bearing are full of stately grandeur. These form but a part of the sylvan deities in whose majestic presence adoration mingles with admiration; these and humbler forms of vegetation, with rock and earth and mountain, are the elements here combined in picturesque harmony, a perpetual feast of beauty, changing only in the morning and evening to put on new splendor in the changing light, and revealing new graces and fresh charms of color and of form. Amid such scenes the California red man, indigenous and to the region born, lived, roamed, hunted and passed away, to be followed by paler faces of exotic lineage, who travel over the long unused and obscure trail, seeking among the chips and stones abandoned by the way, the story of those who made them.

Lack of time prevented investigations elsewhere than at Howell mountain; Angroin's farm is a good point for a base, as well as for recreation, and here more might be done. Pope valley, just over the ridge, should also be explored. It offers great inducements to the ethnologist, the artist and all others who love nature, or who seek for release or rest away from the tumult of traffic and the town.

BARBADOS.

BY F. M. ENDLICH.

AS the good ship *Solent*, of H. M. Royal Mail Service, is slowly steaming into the main harbor of Barbados, a small flotilla of boats gradually accumulates around her. Boats of all sizes, of many colors, and in variable conditions of seaworthiness, contain a motley crew of black oarsmen. While following alongside of the steamer these enterprising substitutes for hackmen keep incessantly shouting, with many gestures:

"Mastah! mastah! here's de boat for ye; take ye right in; go wid de boat of Christopher Columbus; come right 'long, now."

Christopher Columbus is appropriately clad in linen trousers, which once may have been white. The capacious folds of a sea-green "duster" envelops his manly form, and a gray beaver hat with a broad mourning band surmounts his stately figure.

"Shut up dar, you black nigger," chimes in a thick-set darkey of the most pronounced type; "don't go wid dat fellow, mastah; come wid your own little snow drop!"

It is refreshing to note under the sub-tropical sun even this energy of competition. While passengers are listening to the alluring words of numerous boatmen the ship has anchored and everything is made ready for transfer to the shore. A short time must still elapse before the baggage and its owners can be placed into the tossing boat, and meanwhile a new scene presents itself. Rapidly approaching is a skiff propelled by the arms of a strong man. Within it are three or four boys and young men supplied with only a minimum of wearing apparel. Resting a few yards from the steamer the mysterious young darkeys make known the object of their visit:

"Trow down sixpence, mastah! trow him in de watah, far out; trow him far out!"

Compliance with this apparently unreasonable request immediately proves them to be expert divers. With eager eyes and an attitude of intense excitement they closely watch every movement of the passengers who may be standing at the rail. A slight splash may be seen in the water, at once followed by that of four human bodies. Often the coin is recovered even before its last glitter has faded into the dull gray of the water. It is a rare case, indeed, that any sixpence should escape their eyes. Although oc-

casionally a shark's fin may be seen in close proximity, the divers ply their vocation without paying any attention to the rapacious animal. Not until either the patience or small change of passengers has been exhausted will the dripping youths take their departure, seeking fresh fields for their novel enterprise.

Finally the baggage and personel of some particular party is safely stowed away in a rickety boat, which bears the name "Pearl of the Ocean" emblazoned in yellow letters on a pale green ground, and the pull for land is begun. Rowing along and between the various craft which lie anchored here, the breakwater is at last passed and the boat glides smoothly along to one of the wharves. Generally the steamers anchor nearly a mile out, and a fine view of the harbor is afforded during the shoreward trip. The breakwater is a solid stone structure, extending outward for some distance. All boats and smaller ships enter within the shelter it affords and there discharge cargoes. As vessels are constantly arriving and departing, the scene here is one of great interest.

Bridgetown, on the leeward side of the island, is the capital of Barbados. Steamers of various lines stop within its harbor, exchanging freight and passengers. Dozens of lounging darkies, famous for their insolence, line the landing places, and protest to be most anxious to serve every new-comer in any capacity whatsoever. Disinterested as this excessive politeness and attention appears to be at first glance, it is soon changed to disappointment and loudly expressed anger when a successful competitor among them has secured a satchel or trunk and marches off in triumph. That much reviled class, so prominent in our more civilized country, the hackmen, would certainly blush at their own bashfulness and maidenlike shyness could they but join the band of vociferating darkies on the docks of Bridgetown. With the proverbial inconsistency of the children of this world, the rejected candidates turn their wrath upon the unfortunate stranger who has given offence by not employing the entire tribe. Recovering speedily, however, a new victim is attacked and the same scenes are rehearsed. Bridgetown is not well supplied with hotels, and the wanderers usually congregate at the hostelry where Mr. Kingsley is said to have met with so inhospitable a reception upon his arrival at night.

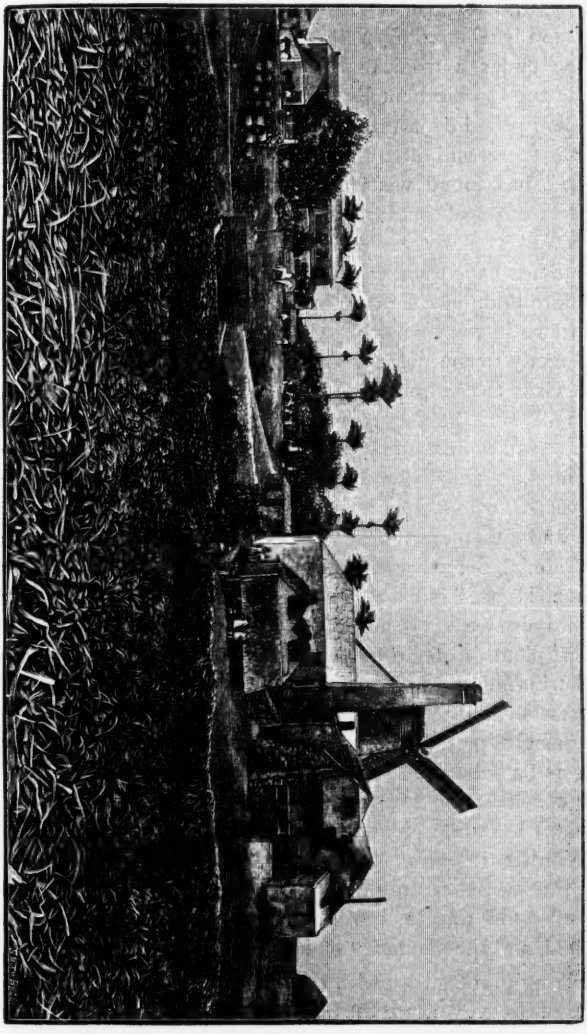
The island of Barbados, most prominent among the Windward

Group, was discovered early in the seventeenth century by Portuguese seafarers. It was taken possession of by British subjects, and settlements were started in 1625. Since that time it has been ruled under the British flag. Until 1627 the island was the property of the Duke of Marlborough, then was transferred to the Duke of Carlisle, and in 1652 was attached under colonial charter to the British crown. During the two and a half centuries that have passed over this flourishing colony its inhabitants have developed an independent, self-reliant character. Dissensions from the opinions of the home government, interior disturbances by insurrection of the colored population, earthquakes and hurricanes, have failed to disturb the proud, hospitable spirit of planters "to the manner born." In 1816 the most dangerous revolt of the negroes laid in waste more than sixty plantations in four days. At present the protection of life and property, by adequate provisions, is made an object of special consideration, and serious trouble is no longer apprehended.

Geologically speaking, the island is coralline in origin and rises to an elevation of about 800 feet above sea level. Gentle slopes, admirably fitted for a high degree of cultivation, characterize its general appearance. Seen from the sea the bright green canefields, separated from each other by roads of glistening whiteness, produce the impression of one great garden. This, indeed, is not lessened when traveling across country, where one estate joins the other, where dozens of sugar-mills in sight betoken the industry and prosperity of planters. But little timber remains on the island, having been removed for various economical purposes. "Parishes" represent the subdivisions of the total area, and a population of about 170,000 inhabitants testifies to the density of settlement.

Bridgetown contains about 50,000 souls. Narrow, irregular streets indicate the older portions of the town. Fine villas and country houses are located in the suburbs. Small wooden huts shelter large families of negroes, while but a short distance off, perhaps, may be the dwelling of an European, who has surrounded himself with everything that good taste and continental habits may require. Large gardens, indicating well developed horticultural ideas on the part of owners, surround the villas. Often the luxurious vegetation completely hides the dwelling from view, with a climate so admirably adapted to plant life, it is not surpris-

ing that many people should cultivate flowers and shrubs. To see plants which grow only in green-houses in the fatherland



Clifton Hall Estate.

scattered in profusion over broad grounds, is so fascinating a sight that its influence can hardly fail to affect individual taste. Prominent among the structures of the town is the "Government

Building." An excellent material for architectural purposes is obtained by simply quarrying the coralline rock. It is readily dressed, well adapted to withstand the effects of the moist climate, and is of dazzling whiteness. Trying as this latter property may be under a tropical sun, the effect is certainly imposing. Within the Government Building are located the legislative, judiciary and postal departments. The colonial parliament holds its sessions there, and often the proud spirit of the "true-born Barbadian" has found vent in impassioned speech, defending the colony from real or fancied encroachments upon its colonial rights and prerogatives on the part of the home government. Able minds have there espoused the cause of their native island, and more than once has the introduction of home-measures been withdrawn in consequence. In all matters, however, not pertaining directly to the colony, its citizens are intensely loyal. Frequent visits to the homes of their childhood, as well as the education of sons at the Alma Mater which once sheltered their fathers, tend to sustain the bond which distance and separate interests might gradually weaken. The executive is represented by a Governor, who is appointed from Great Britain, and to whom legal and other assistance is afforded by the Attorney General, the Colonial Secretary, and officers specially appointed. "Government House" is his residence. It is surrounded by grounds which must appear charming to the northern eye. Luxuriant tropical plants, fostered by the hands of skilled gardeners, a tasteful distribution of flowers, shrubs and trees render the park one of great beauty. Within the mansion the visitor meets with apartments typical of the tropics. Large, high rooms, spacious halls, and a subdued elegance at once denote comfort and judicious consideration for sanitary arrangements. The Governor of Barbados has under his charge several other British islands of the Windward Group. Although each one is relatively independent, this partial centralization of executive authority is productive of good results. Difficulties can thus be more readily adjusted, and the similarity of interests assures coöperation.

Strikingly in contrast with the sable hue and light colored garments of the natives are the bright scarlet coats of English troops. A garrison of 800 men is kept at Bridgetown. By their presence the more or less turbulent spirit of the negro population is subdued and the power is at hand to check any sudden insurrection.

Picturesque among the "Red-coats" is the uniform of native East Indian troops, several companies of which are quartered here. Turbans replace the cap or helmet, wide trowsers and leggings the more civilized pantaloons. Of strong build and finely formed, these troops certainly present the appearance of a foe not to be despised. The policy of retaining men of totally different nationalities is one which, in case of emergencies, must be productive of good results wherever applicable.

Higher educational institutions are represented at Bridgetown by Codington College. It is patronized by the sons of planters and merchants, and has furnished a number of men of considerable local prominence. The building is beautifully situated amidst tall palms and groves of flowering trees which only a tropical sun can produce.

Great interest is manifested by the inhabitants in religious matters. The leading denomination is the Church of England, but others are not wanting, notably the Wesleyan. Every "parish" has one or more churches, and Sunday is observed throughout with a rigor which would do justice to an old puritanical settlement. As is found to be the case elsewhere, so here, the colored population enters most zealously into the services.

Consistent with the character of the economic features of the island, is that of the settlers at the main port. Society in Barbados does not present many classes. Planters and merchants lead in wealth, while the government officials form a separate division distinguished for education and wide experience. Growers of produce are independent, and the complement is made up by workmen and not a few idlers. It is a noticeable feature that on the estates women are far better workers than men and are more reliable. Although a man may have no objections to pulling a heavy boat for several miles in a broiling sun for the compensation of but a few shillings, he would be indignant if requested to work in a canefield at regular and perhaps higher wages. Many of the colored women are tall, well-built, and they move through the streets in a stately manner, certainly never in a hurry. This effect is greatly enhanced by the long trains of their white or light-colored dresses, with which they conscientiously sweep the dusty streets.

Interesting material for study on evolutional development may be found in the growth of a small girl to the dignity of wearing

a long white dress. No doubt, each successive step is to them of the same importance as to their more favored sisters of northerly climes. Covered with but the scantiest apology for a garment, or sometimes elaborately attired in nothing but a string of beads around the neck, the smallest members of the household attend to playing in undisturbed happiness. They are well treated by all and cry by far less than the average country children of our own homes. Entirely at liberty, they roam into the fields, secure a prize in the shape of a huge sugar-cane, and enjoy themselves in gradually chewing up several feet of it. As they grow up their wearing apparel improves. It would be difficult to draw the line sharply at which the most pronounced metamorphosis takes place. By the time they have arrived at an age of comparative usefulness, either at market or in the sugar-house, they have risen to the exalted position of wearing long dresses. While working or walking in the country a "reef" is taken in the dress below the waist. Huge earrings and bracelets begin to ornament the dusky skin and a tastefully draped turban of flashy color protects the head from the rays of a hot sun. The hair is plaited in short, stiff braids and is ornamented with beads and ribbons; a necklace, sometimes more than one, is added; rings with precious glass stones adorn the fingers, and the young woman is ready for an evening promenade. Her good figure and general ornamentation may attract the attention of some stalwart young boatman, and a deepening of color in the dark brown cheeks betrays the blush which his loudly expressed admiration has called forth.

An inconvenient narrowness of sidewalks in town forces pedestrians into the street. There may be found a motley accumulation of donkeys, men, women and children. Once in a while a team drawn by six mules wends its way through the crowded thoroughfare, causing a decided swerving and sudden scattering of the mass of humanity. Here, as on the plantations, women take a leading part in active work. While a great, overgrown darkey may be perched on the top of a cart and allow himself to be drawn by a donkey scarcely larger than a Newfoundland dog, a woman will walk alongside, staggering under a heavy load which she carries on her head. It is amusing to see the accuracy with which these women balance on their heads large wooden trays filled with fruit or vegetables. Both hands free to manage the folds of their ample, flowing dresses, they pass along with heads

held high, ever ready for trade or for friendly gossip with some acquaintance they may chance to meet.

On Friday Bridgetown puts on its gayest colors. This day is devoted to the planters. From all parts of the island they enter the town, they buy and sell, exchange views and opinions with neighbors whom they see but once a week, and finish the day with a quiet rubber of whist or brandy and soda at their club-rooms. To them the news or the day is important, the fluctuations of the market value of sugar and its side-products become living figures. They have founded a "Commercial Exchange," where the latest dispatches and quotations are open to inspection. On this day, too, the "Ice House" becomes an important establishment. Essentially—in spite of the title—this is a restaurant. It is always supplied with ice, with the freshest and best viands, and with various luxuries as to which it seems to have the exclusive control. Every three months a shipload of ice arrives from Boston at Bridgetown. With it come fresh meats, vegetables, beer in casks, oysters in the shell (when in season), and other articles of food destined to tempt an islander whose thermometer usually ranges from 76 to 92 degrees.

For a long time Barbados has been one of the important sugar-producing islands. Every article of value is mentally compared with sugar; the weather is of no importance whatever, except so far as it may improve or injure crops, and the telegraphic news most eagerly read relate to the sugar market. To a stranger the singular unanimity of ideas upon this subject cannot but appear first ludicrous, then very much the reverse. Thorough cultivation of every available portion of the island, careful management and judicious treatment of both the growing canes and the cane-juice have resulted in a high average yield per acre and a total sugar production of about 60,000 tons a year. Molasses and rum are both manufactured as additional products and are exported in large quantities. Ginger is extensively cultivated and forms quite an important item in the trade. Driving over the smooth, white roads, fields of sugar cane are entered immediately after leaving the confines of the town. Prominent in the landscape are the gaunt arms of numerous windmills. Strangely as they may seem out of place at first, their appearance soon has a certain charm and awakens reminiscences of countries far removed from the tropics. Regular, constant winds render the mills a valuable and economi-

cal adjunct to the manufacture of sugar. Located upon rising ground, they furnish power for crushing the canes, thus extracting the juice. From this latter crystalized sugar is obtained by methods of boiling, more or less complex. Briefly reviewing the process of sugar manufacture, it may be stated as follows: The canes are cut, stripped of their blades, carted to the crusher, and the juice expressed. From there the latter is led into vats where an addition of lime assists clarification. It then passes to a series of kettles and is boiled down to a definite density. After being taken from the last pan the mass is allowed to cool and in part

Row of Noble Palms.

crystalize. As soon as the proper time arrives it is either filled into hogsheads and the molasses allowed to drain off, or the latter is removed in centrifugal machines. The article thus derived is directly marketable, but must be refined before acquiring the whiteness and firmness which the American retail consumer desires.

On the estates the planters with their families live in patriarchal comfort. Absence of means of rapid communication, the unforgotten usages of the mother country, and their innate kindness, render them the most courteous and hospitable of hosts. Sur-

rounded by fields which soon will yield golden fruit, and working with an energy which wind, weather or a fluctuating market impose, they lead a regular life, interrupted only by questions of local government, and by attempts at sanguinary revolt on the part of idle or dissatisfied negroes. On high points, exposed to view, for long distances may be seen staffs with movable arms or other indicators. They serve as telegraphic signals, and a menacing attitude on any one plantation will soon be known all over the island. Thanks to good management, however, occurrences such as formerly devastated many plantations are becoming more infrequent from year to year.

Few places, perhaps, can be found which at one glance display so much quiet scenic beauty and at the same time so fully illustrate the power of man as expressed by his industry. Groves of mahogany trees, the slender, graceful form of the noble palm, the clearly cut shore line, and the blue sea beyond, are combined with highly cultivated fields and subservience of wind and water to the will of man.

The products of Barbadian industry are mainly the middle grades of sugar, which are largely exported to England. It seems strange to note, in view of this latter fact, that supplies and other materials are drawn from the United States to a great extent. American meats, canned fruits and vegetables, and even horses and mules, are met with everywhere. Owing to the climate, stock degenerates very rapidly, and neither serviceable animals nor good meat is raised on the island. An exception to this rule must be made in favor of the donkeys, however. Although of sorry appearance and presumably ready to lean up against the nearest post for support, these animals are capable of a prodigious amount of work. Disproportionate as the size of the little brutes and their loads may seem, they trudge steadily along, requiring only occasional physical admonition on the part of their drivers or riders.

On account of the thorough cultivation of the island but few wild fruits are found, and in consequence the table of the working classes is not the most varied one. Salt fish, bread and sugar cane form the staples. Codfish is imported in large quantities, and some of the native fish are prepared in a similar manner. Nearly every man, woman or child, returning from the fields, carries a long succulent cane. Often a small boy may be seen

attached to one end of a cane twice as long as himself, munching away lustily; the hard rind is gradually overcome, and the juice furnishes him his favorite nourishment. In addition to the nutriment obtained in this manner, such process of demolition furnishes an excellent means for passing the time. Few scenes are more ludicrous than seeing half a dozen lazy darkies, of various sizes, lying in some shady corner while munching long cane-stalks with the utmost solemnity. Poor as the fare may be, the people seem to require no better. In part, the indolence of the colored population may be explained by the climatal conditions of the island. Though rains are frequent and cooling breezes are not wanting, the mean temperature is such as to require but very scant clothing. Children are clad at a ridiculously small expense, and shoes are luxuries unknown until the female wearer blossoms into stately maidenhood. By this means one great incentive to work—the supply of clothing for the family—is reduced to a minimum. A few pence per week are ample to keep body and soul together, rum can be stolen, and both may be acquired with but little labor.

Among the native fish the "flying fish" ranks high as an article of food. At certain seasons it may be quite rare, and again appear in abundance. (In March, 1880, flying fish were selling at four cents per hundred at Bridgetown). During our stay we decided to indulge in the sport of catching them, which had been represented to us as an highly enjoyable pastime. A small fishing boat was accordingly chartered, together with a skipper and two men to assist him. Early one morning, long before sunrise, four of us, respectively "England," "Nova Scotia," "Scotland" and "America," stood out to sea. With the usual forethought a sumptuous lunch had been packed into several baskets, rifles and shotguns were taken along to destroy sharks and secure seabirds. Fishing tackle and nets were supplied in abundance; also bait. Not many parties, perhaps, have started with more complete equipments. Our old, gray-haired skipper stood at the helm with imposing gravity while three poles were put up in the boat, and to each of them was attached a rag of triangular shape. Everything was shaky, the seats were very narrow, and our sporting accoutrements occupied by far the greater portion of available space. A brisk breeze, which had been blowing from the start, began to freshen up, the waves were gradually growing

higher, and within the first hour we were all comfortably drenched. This part of the programme seemed in keeping with the expedition, and we silently congratulated ourselves upon so auspicious a beginning. Before long, however, the sea continued making efforts to stow away a portion of its surplus water in our boat, and all hands were requested to "bail out." By means of hollow calabashes this feat was accomplished. After having gone out to sea about twelve miles sails were lowered and we lay tossing about and waiting for fish. All around us we could see the bright bodies of flying fish flash out from the crest of a wave, pass with great rapidity for some distance over the water, and then drop down again. Eventually a few curious individuals arrived, apparently to inspect the sides of our boat. During their examination they encountered sundry hooks, quietly opened their capacious mouths and allowed them to float in. One or two "flops" when brought on board, and they settled down, seemingly resigned, in the water at the bottom of the boat. This sport was surely growing exciting—but slowly. Thanks to the outward trip and the constant motion of our boat—thanks, too, to our elaborate breakfast, which had consisted of a glass of water—we four ancient mariners were beginning to experience a feeling which a novice on board of a ship might designate as "faint." An inexplicable want of energy, a certain absent-mindedness as to the fascinations of fishing, and a decided disinclination to attack our lunch baskets, became painfully noticeable. In order to revive our sunken spirits somewhat (we will generously accord him the benefit of a lingering doubt) this august individual ordered the bait to be brought out. It was brought out. A basket of loose workmanship was filled with fragments of flying fish, which might have been alive two weeks before; at the time, however, they were very dead. This basket was hung over the side of the boat into the water. Evidently the fish appreciated the perfume which thus was spread far and wide, for they came in large numbers within easy reach of our nets. Whether it was the overpowering joy produced by our success, or whether it was grief at the sudden ending of so many fish lives, full of youth and full of promise, we must allow posterity to decide. It is enough to say that "Nova Scotia," "Scotland" and "America" ignominiously collapsed, and "the further proceedings interested them no more." Occasionally a cold, wet fish would alight on the pale face of one or

the other, but beyond a mild protest no action was perceptible. After a sufficient number of fish had been stowed away in the boat by "England" and the natives, the latter proceeded to do full justice to three-quarters of our elaborate lunch. Once more the sails were set and we sped homeward. Wave after wave passed over the dancing boat until finally the shore was reached. Wet, not hungry, trying to look cheerful, but nevertheless with a cart-load of fish to speak for us, we arrived at our hotel near noon. Strange as it may appear, it proved to be a rash undertaking, for some time to come, to mention "flying fish" within hearing of three certain sportsmen.

Barbados has become a prominent health resort, more particularly for fever patients from more southerly regions. For many years the island has been free from serious attacks of epidemic or endemic diseases. South of Bridgetown, a suburb, Hastings, is located, where good sea-bathing and comparatively cool air can be enjoyed. The climate is necessarily enervating, and any stimulant of such character is a welcome change. Many of the planters and merchants have traveled extensively, and their experiences in foreign countries have borne fruit in their own colony.

Once more the gauntlet of officious porters and boatmen must be run, as the southward steamer has anchored off shore. Laden with trophies from the island, with coral shells and other equally bulky souvenirs, the traveler finds himself restored to his temporary floating home, and

> "The ship drove past * * *
> And southward aye we fled."

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COURTSHIP AND MARRIAGE AMONG THE CHOCTAWS OF MISSISSIPPI.

BY H. S. HALBERT.

THE two thousand Choctaws still living in their ancestral homes in Mississippi, retain, in all their pristine vigor, many of the usages of their ancestors. Among these are the methods employed in conducting a courtship and the marriage ceremony.

When a young Choctaw, of Kemper or Neshoba county, sees a maiden who pleases his fancy, he watches his opportunity until he finds her alone. He then approaches within a few yards of her and gently casts a pebble towards her, so that it may fall at

her feet. He may have to do this two or three times before he attracts the maiden's attention. If this pebble throwing is agreeable, she soon makes it manifest; if otherwise, a scornful look and a decided "ekwah" indicate that his suit is in vain. Sometimes instead of throwing pebbles the suitor enters the woman's cabin and lays his hat or handkerchief on her bed. This action is interpreted as a desire on his part that she should be the sharer of his couch. If the man's suit is acceptable the woman permits the hat to remain; but if she is unwilling to become his bride, it is removed instantly. The rejected suitor, in either method employed, knows that it is useless to press his suit and beats as graceful a retreat as possible.

When a marriage is agreed upon, the lovers appoint a time and place for the ceremony. On the marriage day the friends and relatives of the prospective couple meet at their respective houses or villages, and thence march towards each other. When they arrive near the marriage ground—generally an intermediate space between the two villages—they halt within about a hundred yards of each other. The brothers of the woman then go across to the opposite party and bring forward the man and seat him on a blanket spread upon the marriage ground. The man's sisters then do likewise by going over and bringing forward the woman and seating her by the side of the man. Sometimes, to furnish a little merriment for the occasion, the woman is expected to break loose and run. Of course she is pursued, captured and brought back. All parties now assemble around the expectant couple. A bag of bread is brought forward by the woman's relatives and deposited near her. In like manner the man's relatives bring forward a bag of meat and deposit it near him. These bags of provisions are lingering symbols of the primitive days when the man was the hunter to provide the household with game, and the woman was to raise corn for the bread and hominy. The man's friends and relatives now begin to throw presents upon the head and shoulders of the woman. These presents are of any kind that the donors choose to give, as articles of clothing, money, trinkets, ribbons, etc. As soon as thrown they are quickly snatched off by the woman's relatives and distributed among themselves. During all this time the couple sit very quietly and demurely, not a word spoken by either. When all the presents have been thrown and distributed, the couple, now man and wife,

arise, the provisions from the bags are spread, and, just as in civilized life, the ceremony is rounded off with a festival. The festival over, the company disperse, and the gallant groom conducts his bride to his home, where they enter upon the toils and responsibilities of the future.

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EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

—— The utterances of Professor E. DuBois Raymond, at the recent celebration of the birthday of Leibnitz, in Berlin,[1] should have a clearing effect on the intellectual atmosphere of the evolutionists. Professor Raymond exhibits in a marked degree the invaluable quality of intellectual self-control, one which is sometimes wanting to brilliant thinkers. It is perfectly natural for the pioneer, in penetrating a new and unexplored region, to advance with too great celerity, and without giving himself the requisite time to discover the obstacles that may lie in his course. Sometimes it has happened, that, bringing up at the edge of an unexpected precipice, he has made the most astounding leaps, and has been compelled to lay to and repair damages for sometime thereafter.

A good many evolutionists have been floored by a serious interruption to the continuity of their "high priori" road, and not a few of them do not yet know just what has hurt them. That such an evanescent and unsubstantial condition as consciousness should have the gravity necessary to throw a triumphant army of advance into confusion, could hardly be suspected. Does not one of the leaders say that consciousness is to the progress of evolution, what the whistle is to the engine, that makes a good deal of noise but does none of the work? And another says, "If the 'will' of man and the higher animals seems to be free in contrast with the 'fixed' will of the atoms, that is a delusion provoked by the contrast between the extremely complicated voluntary movements of the former and the extremely simple voluntary movements of the latter!" A slight difference of opinion, indeed! One authority tells us that consciousness does nothing, and the other will have it that it does everything, rising even to the autonomic dignity of a "will" for atoms! They agree in believing

[1] See translation in *Popular Science Monthly* for February, 1882.

consciousness to be a form of force; but they differ in that the first authority thinks it is all dissipated, while the other holds it to be a link in a continuous chain of metamorphoses equivalent to every other link. If this be so, and the continuity be unbroken, what iron-clad fingers must these doughty soldiers have, who by merely putting pen to paper open the mouths of so many cannon, inaugurate so many conflagrations, and explode so many magazines. Verily we should have a new anatomy of this five-barreled mitrailleuse, through whose chambers flash such world-moving forces. As to the source of all this power, well says Drysdale, that if the brain of man contains stored such tremendous potency, its escape should, on his leaving this earthly abode, blow the top of his head entirely off.

As usual, truth lies between these extremes; furthermore, a very fundamental truth has been neglected by both sides of the question. Says Raymond, "More temperate heads betrayed the weakness of their dialectics in that they could not grasp the difference between the view which I opposed, that consciousness can be explained upon a mechanical basis, and the view which I did not question, but supported with new arguments, that consciousness is bound to material antecedents." This position has been maintained by various writers, among them Professor Allman,[1] and some of the editors of this journal. But Professor Raymond has not found it to be acceptable to his nearest cotemporaries. He says, "The opposition which has been offered to my assertion of the incomprehensibility of consciousness on a mechanical theory, shows how mistaken is the idea of the later philosophy, that that imcomprehensibility is self-evident. It appears rather, that all philosophizing upon the mind must begin with the statement of this point." In stating this point some years ago, we used the following language:[2] "It will doubtless become possible to exhibit a parallel scale of relations between stimuli on the one hand and the degrees of consciousness on the other. Yet for all this it will be impossible to express self-knowledge in terms of force." And again,[3] "An unprejudiced scrutiny of the nature of consciousness, no matter how limited that scrutiny necessarily is, shows that it is qualitatively comparable to nothing else. * * From this standpoint it is looked upon as a state of matter which is coëternal with it, but not coëxtensive."

A second self-evident proposition is the following: There is no equivalency or correlation, between the force expended in the maintenance of conscious states, with the energy displayed in those acts which result from those conscious states. Parallel relations between ordinary forces are seen in cases of release.

[1] Address delivered before the British Association for the Advancement of Science, 18—.

[2] Consciousness in Evolution, *Penn Monthly*, July, 1875.

[3] The Origin of the Will, *Penn Monthly*, 1877, p. 439.

Thus the force that applies light to the fuse is little comparable to the explosion of the blast. The force required to raise the sluice is small compared with that which runs the mill. Still less is the relation of the force expended in planning a campaign to that required in executing it; or, of that used in directing a body of laborers to that expended by the laborers themselves. This is easily understood, but it is not so generally perceived by some of the correlators, that a process of exactly the same kind takes place in the mechanism of the acts which transpire within the animal organism. The amount of the primitive force may be very minute, for several releases may separate the thought from the ultimate result.

In the cases above mentioned the mind only serves as a release to the muscles which act, before the latter in turn release still mightier forces. But these facts do not permit the supposition that the original conscious state is not an equivalent of forces both antecedent and subsequent. For without the decomposition of arterial blood and the oxygenation of tissue, consciousness could not exist, and the beginning would not begin.

A third self-evident proposition is this: Movements determined by sensations cannot be compared to those which are not so determined. The former move towards the locality of pleasure, and away from the locality of pain. The latter move in the direct ratio of the product of the masses, and in the inverse ratio of the square of the distance. In the former case there is no equivalency between the force of the originating stimulus and the resulting act, and energy is generally gained in the process; in the second case the correlation is exact, and if there be any difference between the energy of the cause and that of the effect, that which has been dissipated by the way can be accounted for by proper search. But the biologist has much to do with a large class of designed movements, or acts, which are not performed in consciousness, and it is these which are likely to produce a confusion in the mind in regard to the relation between the movements of living and non-living masses. Thus a class of writers compare the hunger of the lowest animals to the affinities of chemical substances, etc., a supposition clearly inadmissable on physical grounds alone. The easiest solution of the problem lies in the well known ease with which conscious acts become automatic and unconscious, so soon as the structural lines which give direction to the force have become organized. Consciousness thus appears as the creator of designed movements, and the resulting organism their sustainer.—*C.*

RECENT LITERATURE.

BALFOUR'S COMPARATIVE EMBRYOLOGY. Vol. II, Vertebrates.[1]—After finding the first volume of this work so useful, accurate and suggestive, we were prepared to welcome the appearance of the second volume, which certainly fulfills the high expectations formed after reading and frequent reference to the first. Our anticipations are fully met, and the entire work for the first time places in the hands of the student a reliable and critical account of the general mode of development of members of each great class of the animal kingdom. The facts have been gathered and compiled from a great variety of sources, for the literature of embryology has multiplied excessively since 1860, the larger proportion of articles and memoirs having, indeed, been published within the last decade.

The first third of the volume is devoted to a general account of the development of each class above the Arthropods, with which the last volume closed—*i. e.*, the groups *Cephalochorda*, containing the single genus Amphioxus; the *Urochorda* or Tunicata, and the *Vertebrata*. This part of the volume contains a good deal of original matter contributed by the author and a few other embryologists, together with the most recent results of embryological studies, so that we will glance at some new points which meet one's eyes in the early pages.

The peculiarities in the development of the Teleostean egg, says Balfour, can best be understood by regarding it as an Elasmobranch egg very much reduced in size. "It seems, in fact, very probable that the Teleostei are in reality derived from a type of fish with a much larger ovum."

The lamprey is regarded as the type of a degenerated but primitive group of fishes, whose development, however, does not throw any light on its relationship. If so, we do not see why the author places it in his classification or phylogeny above so special and recent a group as the bony fishes. He then says that "the similarity of the mouth and other parts of Petromyzon to those of the tadpole probably indicates that there existed a common ancestral form for the Cyclostomata and Amphibia. Embryology does not, however, add anything to the anatomical evidence on this subject." On the other hand, he does not assent to Dohrn's view that the lampreys have descended from a relatively highly organized type of fish.

Had space been allowed we would like to have had fuller statements concerning the later stages of the lancelet, as well as of the ascidians. Concerning Myxine no reference is made to Steenstrup's paper, wherein the eggs are figured. Neither is a paper on Amphioxus in this journal (Jan. and Feb., 1880), by H. J. Rice, and containing new facts and drawings, noticed.

[1] *A Treatise on Comparative Embryology.* By FRANCIS M. BALFOUR. In two volumes. Vol. II. London, Macmillan & Co., 1881. 8vo, pp. 655. XXII.

We have in this work, for the first time in connected form, the comparative embryology of the Ganoids, the researches of Salensky on the sturgeon, and of A. Agassiz on the gar-pike, supplemented by those of the author, assisted by Professor W. K. Parker and his son, W. N. Parker, giving us a good idea of the development of two principal types. In the sturgeon the segmentation of the yolk is complete, but the embryo does not become folded off from the yolk in the manner usual in Vertebrates, while the relation of the yolk to the embryo is unlike that in any other known vertebrate. Before hatching the embryo has, to a small extent, become folded off from the yolk both anteriorly and posteriorly, and has also become, to some extent, vertically compressed. Owing to these changes, it resembles somewhat the embryo of a bony fish. According to Parker, in older larvæ a very rudimentary gill appears to be developed on the front walls of the spiracular cleft, while the gill-papillæ of the true branchial arches are of considerable length. There is a suctorial disk, with slender papillæ, which probably ultimately become the barbels, and a corresponding but temporary one arises in the gar-pike.

In the gar-pike, besides the discoveries, as respects the later stages, made by A. Agassiz, the segmentation is total; but the early stages of the embryo show a remarkable resemblance to those of bony fishes. Both the head and tail become early folded off from the yolk, as in bony fishes. The yolk in the gar forms a special external yolk sack, instead of an internal dilatation of part of the alimentary tract as in the sturgeon, and besides, in the gar it is placed behind instead of in front of the liver, as in the sturgeon. A knowledge of the mode of development of the Ganoids is, of course, most important, since from them the Amphibia are supposed to have been derived. But, as Balfour observes, there are no very prominent Amphibian characters in the development of either type, otherwise than a general similarity in the segmentation and formation of the germ-layers. So that no light is thrown by embryology on the origin of the Amphibia. In considering the development of the Amphibia a good deal of stress is laid on the resemblance between the mouths of the tadpole and the lamprey, and Balfour thinks that these are not merely the results of more or less similar habits. Says Balfour: "In dealing with the Ganoids and other types arguments have been adduced to show that there was a primitive vertebrate stock provided with a perioral suctorial disc; and of this stock the Cyclostomata are the degraded, but at the same time the nearest living, representatives. The resemblances between the tadpole and the lamprey are probably due to both of them being descended from this stock. The Ganoids, as we have seen, also show traces of a similar descent; and the resemblance between the larva of Dactylethra, the Old Red Sandstone Ganoids and Chimæra probably indicate that an extension of our knowledge will bring to light further affinities between the

primitive Ganoid and Holocephalous stocks and the Amphibia."—*(To be continued.)*

GILL'S RECENT PROGRESS IN ZOOLOGY, FOR THE YEARS 1879 AND 1880.[1]—Few indeed of the numerous students of zoölogy in this country have time or opportunity even to glance at the work done each year by English-speaking naturalists, and still fewer are able to become acquainted with the work of foreign naturalists except through notices in scientific journals. To all, therefore, the present pamphlet, written as it is by one who by long study of the subject is well qualified to undertake such a work, will prove most valuable,

After noting that the prominent feature of zoölogical progress during the period reviewed has been the discovery of numerous deep-sea types, and criticising the ordinal classification of Fishes and Birds put forward by certain zoölogists, Dr. Gill proceeds to give a short separate account or abstract of papers containing discoveries of importance.

Among the subjects treated of are the following relating to invertebrates: Anal respiration; the effects of variously colored light upon the development of ova; the effects of starvation upon the human system, from the studies of surgeons during the late famine in India; the Pheodaria, a new group of Rhizopods allied to the Radiolaria, but constituted a class by Haeckel, who enumerates more than 2000 species; the discovery of medusæ in brackish and even in fresh water; a new order of Holothuroids (the *Elasmopoda*); a curious ophiuroid, with asteroid characters, found near Madagascar; the Orthonectids; *Polygordius* and its relationships; parasitic Planarians and Nemerteans; the relations of the Chætognaths and of *Peripatus*; the resemblance between the eyes of Limulus and of Trilobites; aborted development in decapod crustacea; *Scolopendrella*; the phosphorescence of glow-worms; the relations of the Polyzoa; the range in depth of living Brachiopods; worm-like mollusks (*Neomenia* and *Proneomenia*); the regeneration of parts in Gastropods; *Gastropteron;* recent Pleurotomariids; the dentition of the Marginellidæ; the relation of the arms and siphons of cephalopods to structures found in gastropods; and recently described North American Cephalopoda.

Among the vertebrates Dr. Gill, as might be expected both from the general direction of his own labors and from the extensive work performed upon our coasts by the Fish Commission, devotes most space to the Pisces. The principal works published upon this branch are noted, and mention made of the numerous workers who have described new species, anatomized known species, or discovered fossil forms. Then follow notices upon the origin of sounds produced by fishes; the functions of the air-bladder; the temperature of fishes; the ovaries of teleosts; the

[1] *An Account of Recent Progress in Zoölogy, for the years 1879 and 1880.* By THEODORE GILL. From the Smithsonian Report for 1880.

flight of flying fishes; the affinities of the fossil *Platysomidæ* and *Palæoniscidæ*, and of *Pleuracanthus;* and the sexes of eels. Among new discoveries are noted two species of *Pleuronectidæ* (in the sense given to the term by Dr. Gill) without pectorals upon the blind side; the genera *Icosteus* and *Icichthys*, curious soft-boned California fishes, which have been constituted a "family" by Professor Jordan; *Lopholatilus*, a new economical fish; the Rock-fish of California, and a deep-sea Sebastes found off Inosima, Japan.

The activity of ornithologists has produced numerous faunistic works, notably upon the birds of Papua and the adjacent islands, and several families have been monographed. After notes upon the Odontornithes, Archæopteryx, and the extinct parrot of Bourbon, Dr. Gill turns to the mammals, commencing, as in other groups, by enumerating the features of progress. Then follow a condensation of the views of various naturalists on the progenitors of mammals; a synopsis of Marsh's work on Jurassic Mammals; notes on the discovery of new Monotremes and Marsupials in New Guinea; on a plague of rats which occurs in Parana (Brazil) at intervals of thirty years; on the habitat of *Lophiomys imhausi;* on the gestation of the elephant and length of life of the hippopotamus; and lastly, a short account of Professor Cope's articles upon the extinct cat-like animals of America and the relations of the horizons of extinct Vertebrata in Europe and in North America.

Dr. Gill utters a warning, by no means without reason, against the use of the word "order" to define groups which have less value than the sub-orders of mammals, and is especially severe upon Dr. Sclater for the recognition of two sub-classes and twenty-six orders in the homogeneous class of Birds. It would be well for all systematists to remember the warning, and to remember also that the same criticisms apply to the undue multiplication of families and genera. Nor does our author neglect the opportunity of throwing another stone at Dr. Günther for the mistaken conservatism which impels that excellent ichthyologist to retain the Cuverian orders of the Teleosts, to include sharks and Chimeroids in the same order, and in various other ways to ignore broad morphological facts.

THORELL'S SPIDERS OF MALAYSIA AND PAPUA.[1]—A third part of this extensive work has just been received. It forms a bulky and handsomely printed work of 720 pages, but without any plates. It forms volume XVII. of the Annals of the Civic Museum at Genoa, one of the most active scientific societies in Europe, and is another evidence of the scientific awakening now pervading the kingdom of Italy, and which is undoubtedly due largely to the freedom and political progress of the Italian nation resulting from the loss of the temporal power of the Pope. The collections which form the base of the present descriptions were those made

[1] *Studi sui Regni Malesi e Papuani.* Per T. THORELL. III. Genoa, 1881. 8vo.

by Professor O. Beccari at Amboina and by this explorer, who went in company with D'Albertis to New Guinea, together with collections from other parts of the Malay Archipelago. Dr. Thorell prefaces his work with valuable remarks on the geographical distribution of the spiders of this region and gives a full account of what has been done in the field by his predecessors.

THE DISTRIBUTION OF NORTH AMERICAN FRESH WATER MOLLUSCA.[1]—Professor Wetherby's endeavor, in this interesting article, is to trace the causes which have led to the great differentiation of the fresh-water mollusks and to distinguish the various faunæ. The Limneidæ, circumpolar in their distribution, are most abundant in the lake region of the Archæan lands, and are essentially lacustrine, although a few are fluviatile. The Unionidæ are most abundant in the region drained by the Ohio, and the typical Ohio forms are continued across the Mississippi to the Rocky Mountains and southward to Texas, but in vastly diminished numbers. South of the Ohio and east of the Mississippi, both within and without the Ohio drainage, many of the Unionidæ are evidently closely related to Ohio types, but along with them, principally in small mountain streams, occur species which have a very different facies, and belong to a different fauna. Such are *U. spinosus* and *U. collinus*, the only spinous Uniones.

The Strepomatidæ first appear in New York, and are almost confined to the district occupied by the peculiar Unionidæ just mentioned. They do not cross the Mississippi, and are chiefly found in mountain streams.

The Unionid genus Anodonta is abundant with the Limneidæ of the Archæan lake regions, and plentiful over the northern part of the region occupied by the Uniones, but gives way southward to Unio. Most of the described species of Anodonta and Unio are mere varieties, and even Dr. Lea has to confess that he can find no satisfactory anatomical differences in the latter genus, yet there are many types that must be called species.

Reviewing these facts, Professor Wetherby concludes that the Limneidæ form the oldest fauna, and that the typical Ohio forms spread from the Palæozoic lands of the Northern States, and are older than those found in the Mesozoic and Tertiary regions of the South.

These latter he refers to a Palæozoic ancestor whose home was in the western archæan region.

All fresh-water mollusks were originally lacustrine, adapted themselves first to the change from salt to fresh water, and afterwards to the more rapid change caused by the elevation of mountain ranges, and the conversion of lakes into flowing water. Hence the most striking and peculiar forms are found in the mountain streams of newer regions and have not yet had time to

[1] *On the Geographical Distribution of Certain Fresh Water Mollusks of North America.* By A. G. WETHERBY, A. M. Jour. Cincin. Soc. Nat. Hist., July, 1881.

spread. All the species, originating in the head-waters, propagated down-stream, and thus arose the overlapping of faunas, and probably the disappearance of many faunæ as peculiar as is that of the Alabama, which contains, besides some distinctive Unios and a singular Goniobasis, two Strepomatid genera, Schizostoma and Tulotoma, with thirty species, none of which were found elsewhere.

ZITTEL'S HANDBUCH DER PALÆONTOLOGIE.[1]—This standard and fresh work on general palæontology is slowly appearing in numbers, the present one beginning the treatment of the Mollusca. One important feature of the present number are the two hundred excellent wood-cuts of fossil Lamellibranchs. The orders, families and leading genera are briefly described and the typical species mentioned. The systematic portion is succeeded by a brief section on the distribution of Lamellibranchs in geological time. It appears that of all fossil mollusks the Lamellibranchs constituted a fourth part in the palæozoic period, in the Jura and chalk periods one-half, and in the Tertiary period a third part.

MARTIN AND MOALE'S HOW TO DISSECT A CHELONIAN[2].—This little book is the first of a series designed to form a handbook of vertebrate dissections. The directions given are meant for use in connection with lectures, and the reading of a good text-book and some knowledge of human osteology on the part of the dissector is assumed by the author. The species dissected is the red-bellied, slider terrapin *(Pseudemys rugosa)*. After stating the zoölogical position of this terrapin in general terms, taken, with slight modifications, from Huxley, the student is then led to examine briefly the general external appearance of the animal, and then clear, succinct, and, we should think, sufficiently full directions how to dissect the creature are given. The method pursued is not comparative, but special; we should look for the introduction of the comparative method in the succeeding parts. No illustrations of the soft parts are given. A frontispiece is devoted to good figures, showing the different parts of the skull. The book is useful, and one which is needed.

PACKARD'S ZOOLOGY, THIRD EDITION[3].—The changes made in this edition consist mainly in the correction of errors, the results of suggestions and criticisms from naturalists and teachers. Among the changes and additions are references to Ryder's *Symphyla*,

[1] *Handbuch der Palæontologie.* Herausgegeben von KARL A. ZITTEL. 1. Band. 2. Abtheilungen. I. Lieferung, mit 200 original-holz-Schnitten. München und Leipzig, 1881. 8vo. Preis Marks 7.

[2] *Handbook of Vertebrate Dissection.* Part I. How to Dissect a Chelonian. By H. NEWELL MARTIN, Professor in the Johns Hopkins University, and WILLIAM A. MOALE, M.D. New York, Macmillan & Co., 1881. 12mo, pp. 94. 75 cts.

[3] *American Science Series.* Zoölogy for High Schools and Colleges. By A. S. PACKARD, Jr. Third edition, revised. New York, Henry Holt & Co., 1881. 12mo, pp. 719. $3.

which is regarded as a sub-order of Thysanura, while the recent views of Semper and Moseley as to the formation of coral reefs are briefly referred to. The index has been altered to correspond with changes in the text.

VERRILL'S CEPHALOPODS OF THE NORTHEASTERN COAST OF AMERICA[1].—This is a memoir of 267 pages, with 44 plates, upon the species of Cephalopods which have been collected upon the Atlantic coast of the United States, mostly within a few years, by the United States Fish Commission and the United States Coast Survey. It is a monographic account of these animals, accompanied by most excellent plates from drawings by Mr. Emerton. While the bulk of the work is devoted to careful descriptions of the species, the gross anatomy of a number is given and illustrated, and the habits of some of the common species described. Besides the descriptions of gigantic squids and the excellent drawings illustrating them, the point of most interest brought out by the author is the description of the cone discovered by Mr. W. H. Dall in *Moroteuthis robusta* Verrill. It is figured on Pl. XXIII, and thus described by Professor Verrill: "This genus will have, as known characters: A long, narrow, thin pen, terminating posteriorly in a conical, hollow, many-ribbed, oblique cone, which is inserted into the oblique, anterior end of a long, round, tapering, acute, *solid*, cartilaginous terminal cone, composed of concentric layers and corresponding to the solid cone of *Belemnites* in position and relation to the true pen."

This is a most interesting discovery, for we are now able to understand the relation of the cones described as Belemnites, which have usually been homologized with the pen or bone of cuttle-fishes. The Moroteuthis is a gigantic calamary, but the ordinary Belemnites may have been closely related in form to our hooked calamary, and a cone three inches long may have been worn by individuals not over two feet long, and not differing essentially in form from our common Ommastrephes. The cone is present or absent apparently in quite closely allied forms. We wish the author had made a little more of a subject of so much palæontological interest.

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Ueber Plicatocrinus fraasi aus dem oberen Weisser Jura von Nusplingen in Würtemberg. Von Dr. K. A. Zittel, K. Bayerischen Akad. 8vo, pp. 12, 2 plates. München, 1882. From the author.

[1] *The Cephalopods of the Northeastern Coast of America.* Parts I, II, 1879–1881. From the Trans. Connecticut Academy of Sciences, Vol. V.

L'ontologie ou La Science de L'étré démonstration Scientifique de la Vie eternelle. Par J. Jolivalt. G. Fischbacher, editeur. 12mo, pp. 212. Paris, 1881. From the editor.

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Some notes on American Land Shells, No. II. By A. G. Wetherby. 8vo, pp. 13. Journal of the Cincinnati Society of Natural History. Cincinnati, Dec., 1881. From the author.

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Contributions to North American Ethnology. Houses and House-life of the American Aborigines. By Lewis H. Morgan. 4to, bound, pp. 282, 55 plates, cuts and figures. Department of the Interior, U. S. Geol. and Geog. Surv. of Rocky Mountain region. J. W. Powell, in charge for the director. Washington, 1881.

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——:o:——

GENERAL NOTES.

BOTANY.[1]

GORDONIA PUBESCENS L'HER (FRANKLINIA ALTAMAHA MARSHALL).—This tree, so far as I can learn from the records, has not been found in the uncultivated state since 1790, when Dr. Moses Marshall saw it near Fort Barrington, on the Altamaha river, in Georgia.[2] It was first discovered by John Bartram in the course of his travels (as botanist to the king) through the Carolinas, Georgia and Florida in 1765. His son William, then only a lad,

[1] Edited by PROF. C. E. BESSEY, Ames, Iowa.

[2] See his letter to Sir Joseph Banks, p. 563, in Darlington's "Memorials of Bartram and Marshall."

accompanied his father in his travels. Afterwards, in 1773, William Bartram undertook, in the interests of Dr. Fothergill, of London, a journey through the same region. His book of travels was published in London in 1794. He states that he found it as he journeyed southwards in the summer of '73 near Fort Barrington, where he had seen it ten or twelve years previously as he traveled with his father. After concluding his travels, which extended as far west as the Mississippi, and occupied several years, he returned to Fort Barrington in the autumn of 1778, to collect and send off seeds, roots, etc., of such plants as he had seen in his way. He there found it again in mature fruit, and states that he saw "two to three acres covered with the tree." The seeds collected by the Bartrams were distributed in this country and in Europe, and the trees growing from these seeds are all that we have left of the original discovery a hundred years ago.

In March last I was requested by Professor C. S. Sargeant, who is in charge of the Forestry Department of the Tenth Census work, and also agent for the American Museum of Natural History in New York, to make an effort to rediscover the long lost tree, wood specimens of which were wanted to complete the series of forest trees of the United States for the Government, and also for the museum; to investigate its habits in the wild state, and to learn more of its geographical range. For that purpose I made a visit to Darien about the middle of March. At that time my only guide to the locality was the simple reference in our botanical books—"*found at Fort Barrington, on the Altamaha.*" I supposed at first it was to be sought for in the river swamp, but on consulting Mr. Bartram's Travels and learning more of the topography of the country I became convinced that it was not in the river swamp, it was to be looked for but in the flats and pine land branches.

Barrington stands on the north side of the Altamaha and about 16 miles from Darien, where the river has bluffs on its northern banks, thus throwing the whole swamp on the south side. The road from Darien, the same as it was a hundred years ago, passes mostly through damp, flat pine woods, until within about three miles of the fort, where commences a succession of dry and rolling sand hills, which extend up to the river. The site of the old fort is still to be seen, with its ditches and embankments marking the outlines. It retains the old name, and is now known as one of the ferry crossings of the Altamaha river.

I went up to Darien in company with a friend, traveling the same old road which the Bartrams and Marshall had used. We made diligent search on the way, but could not find it. This season of the year was unfavorable for the search for an unknown tree, as leaves, flowers and fruit had all disappeared. During the summer my friend, who has good knowledge of the flora of that region, went up three times—in June, July and September—making careful examinations along the road and the flats and

branches near by, but failed to find it. He saw an abundance of *G. lasianthus* and *Pinckneya pubens* in bloom, but the object of our search could not be found. I made a recent visit to Darien in November. We went together again, making the fifth visit to the supposed locality. The following paragraph from William Bartram's account of his discovery of this tree furnishes the clue by which I was guided in my search. After detailing the events of his journey southward from Philadelphia to Darien he says: "I set off early in the morning (from Darien) for the Indian trading house on the river St. Mary, and took the road up the north-east side of the Altamaha. I passed through a well-inhabited district, mostly rice plantations on the waters of Cat Head creek, a branch of the Altamaha. On drawing near the fort I was delighted at the appearance of two beautiful shrubs in all their blooming graces. One of them appeared to be a species of Gordonia, but the flowers are longer and more fragrant than those of the *Gordonia lasianthus.*

Now this paragraph gives a clue to the situation. 1st. As he journeyed from Darien, it was, of necessity, *on the north side of the river;* 2d. "As I drew near to the fort." This is ambiguous, and may mean a few hundred yards, or even two or three miles, in a ride of 16 miles; 3d. The tree was evidently *in sight from the road, and probably not far off*, so as to be readily seen by any one passing that way; 4th. It was growing in company with another showy, flowering shrub. This other flowering shrub was most probably *Pinckneya pubens* (which was finely in bloom in June and July when my friend went up). The only other showy, flowering shrub which I saw in that region was *G. lasianthus*, and as Bartram knew that very well, the probability of its being Pinckneya is increased.

Now about two miles from the fort, and just at the commencement of the sandhills, the road passes between two pine land branches within 40 or 50 yards on either side, spreading out into flats which approach almost up to the road. Here was an abundance of Pinckneya on both sides, in fact the principal growth, and also the *only specimens seen from the road between Darien and the fort.* I suppose, at a rough estimate, there may have been "two or three acres covered with the tree," as Mr. Bartram states. They are so near the road, and so conspicuous when in bloom, as to arrest any one's attention, and especially one who was looking out for new plants. All the indications seemed to point to the spot as the one where the Franklinia was discovered. If, as I suppose, Pinckneya was the accompanying shrub, it reduces it almost to a certainty, as we saw Pinckneya nowhere else on the route. We stopped here, and my friend and I made a close and exhaustive search on both sides of the road. We saw plenty of *G. lasianthus*, and I gathered seed vessels of Pinckneya, but Franklinia was not to be seen. After satisfying ourselves that it was not

there we rode on towards the fort, and then returned from the fifth unsuccessful search.

Whilst in Darien I met Mr. Cowper, a son of Hon. J. Hamilton Cowper, who was well known some forty years ago among scientific men for his culture and refined hospitality, and for the great interest he took in the natural sciences. Mr. Cowper informed me that his father had collected in his grounds all the trees and shrubs indigenous to that section of the country, but *did not have Gordonia pubescens* among them; that he himself had been hunting for it for several years past, having been up frequently to Barrington looking both in the river swamp, on the south side, and in the woods and branches on the north side. I also heard whilst there that a collector of seeds from some Northern house had come on from Florida to hunt for the Gordonia near Barrington, and that he was also unsuccessful.

What are we to think of all this? The two Bartrams and Moses Marshall saw it 100 years ago, without any doubt, for the trees growing from the seeds which they distributed give conclusive proof of its existence at that time, and in considerable quantity, in that locality. Since then it has been lost, even to the people of that region, and, as far as I can learn, has never been seen elsewhere. Was it confined to that single locality, and has it become extinct? This supposition is scarcely admissible without very strong proof. I confess I am at a loss for any explanation of its disappearance. I have thus given a minute and detailed account of my unsuccessful efforts, in the hope that it may assist any future explorer to solve the mystery of *Franklinia altamaha.*—*H. W. Ravenel, Aiken, S. C., Jan. 6, 1882.*

DIATRYPE DISCIFORMIS (Hoff) Fr.—It has been noted that the American specimens referred to this species differ somewhat from the common European type, though the difference has not hitherto been considered sufficient to warrant a specific distinction. European specimens from Cooke, Winter, De Thümen and Plowright are on beech, but, according to Fries, it occurs also, though more rarely, on oak and birch. American specimens in Rav. Fungi Car. and F. Americani are on *Magnolia glauca*, on the dead trunks and branches of which it seems to be very common from Southern N. J. to Florida. It is the form on Magnolia of which I wish to speak. In the spring of 1875 I sent specimens of this fungus to Baron de Thümen, who distributed them in his Mycotheca Universalis (No. 359), and afterwards in the Bull. of the Torr. Bot. Club, Vol. VI, page 95, published it as *Diatrype disciformis* Fr. var. *magnoliæ* Thm., noting that it differed in its smaller disk and indeterminate ostiola from the European form. Some years ago I had noticed that occasionally a magnolia trunk would be found on which the specimens of this fungus all presented a concave disk, depressed even below the general surface of the bark with white, dot-like punctures marking the place of the

ostiola, and differing so much from the ordinary form that it might readily be taken to be a different species. The asci and sporidia, however, did not differ from those of the more common form.

In the autumn of 1874 a single magnolia trunk was found thickly covered with what was taken to be an old Diatrype, with the disks covered with little circular orange-red tremelloid caps of the same size as the disks and hiding them completely from sight. This was at that time supposed to be a species of Tremella, but it did not show the internal structure of that genus, nor could it be referred to any described species. So the matter remained till last November, when, on a collecting trip in the swamp, I again found a magnolia trunk covered with the little orange-red tremelloid disks. On removing one of these carefully with the point of a knife, behold the concave disk of *Diatrype disciformis* (?) with the white dot-like punctures marking the place of the ostiola! On further examination it was found that on some parts of the trunk the tremelloid disks had already fallen away, laying bare the white punctured stroma of the Diatrype. Another specimen on the same trunk had still further developed into the well-known form of *D. disciformis* var. *magnoliæ*. On looking further there were found a dozen or more trunks, all bearing specimens covered with the tremelloid disks as above described, showing plainly the various stages of development and demonstrating beyond the shadow of a doubt that *D. disciformis* var. *magnoliæ* has in the young state its stroma covered with the aforesaid tremelloid disks. I could not at first see why I had not noticed this before, as the magnolia and the Diatrype in question are very common: but this may be due to the fact that the little tremelloid disks do not long endure, but soon turn black and fall off.

The origin of the fungus is beneath the epidermis, which is soon ruptured and thrown off, revealing the red disk, which soon rises up even with or a little above the surface of the bark, soon after which, as already stated, it also falls off, revealing the true disk of the Diatrype, which, in the different stages of its growth, presents at least three different forms—first, concave and slate color, with white dot-like punctures; then convex and brown, the surface being slightly cracked and the ostiola scarcely visible; and finally the disk becomes black and the ostiola distinctly prominent. When it reaches this stage the asci have mostly disappeared.

It is further to be noted that in the European specimens of *D. disciformis* the epidermis does not adhere to the margin of the disk but forms a loose, free border around it, while in the specimen on magnolia the epidermis is closely adherent to the margin of the disk, and is also split in a stellate manner around it. In view of the facts now stated, it appears to me that *Diatrype disciformis* var. *magnoliæ* is worthy of specific distinction, and I have prepared specimens to be distributed in the next Century of North Am. Fungi, under the name of *Diatrype tremellophora.*—*J. B. Ellis, Newfield, N. J., Jan. 3, 1882.*

BOTANICAL NOTES.—Dr. Sternberg has seen "prehensile filaments" of protoplasm in a species of Navicula, and is thus able to confirm Dr. Wallich's views as to the motions of diatoms. In a letter to the *American Monthly Microscropical Journal* he says: "I have seen them frequently in certain diatoms [Navcula] found in abundance in the gutters of New Orleans." He used a 2-5 per cent. solution of iodine for suddenly killing and staining the filaments.——It is announced in English journals that B. D. Jackson, Secretary of the Linnean Society, will shortly bring out a new edition of Steudel's *Nomenclator Botanicus.*——Dr. Thurber is to publish a new edition of "American Weeds and Useful Plants," and asks for notes upon new weeds, directing attention especially to the aggressive grasses. Specimens are desired, and should be sent to 751 Broadway, New York.——S. E. Cassino, of Boston, announces for publication, at an early date, "A Manual of the Mosses of the United States," by Leo Lesquereux and Thomas P. James. It will contain nine or ten copper-plates illustrating the genera.——The same publisher announces also a "Manual of the Lichens," by Professor Tuckerman.——A. H. Curtiss' Fascicle v. of his southern plants is one of the most interesting yet sent out by him. Several of the specimens represent new species, some of which are curious. Some are new to our flora, as *Catesbœa parviflora*, a remarkable shrub from Southern Florida. This year (1882) Mr. Curtiss intends to spend in collecting in the Smoky mountains of East Tennessee.——M. E. Jones, of Salt Lake City, has recently sent out his catalogue of specimens of California Plants, to be issued in fascicles. Many interesting species are represented, and this, with the low price ($30 per fascicle of 500 species), will make these sets very desirable.

ZOOLOGY.

NESTING HABITS OF THE HORNED LARK.—In the November number of the NATURALIST, Mr. Aldrich, of Webster City, Iowa, notices the finding of a bird's nest with eggs, near the Agricultural College, on the last day of March, which he ascribes to the snow-bunting *(Plectrophanes nivalis)*. In this he must be mistaken, as no bird of that species probably ever nested within a thousand miles of Iowa. There are, I believe, only two records of its breeding in the United States, and both of those were in New England. The bird to whom the nest that he discovered really belonged, was probably the horned lark *(Eremophila alpestris)*. This bird habitually winters in Iowa in great numbers, and many remain to breed, which they always do very early in the season, with little apparent regard to temperature. Professor Arthur, of Charles City, Iowa, tells me that he has seen the snow blowing over the nest and mother-bird when the weather was as severe as midwinter. Some specimens that I shot in February and dissected, showed by the condition of the sexual organs, that the breeding

season was at hand, in fact they were evidently mating when killed. I will add that a short time after Mr. Aldrich's visit I obtained for the college museum a nest with eggs from that same "little knoll" of which he speaks, while another nest was found with young, which was very likely the one that he saw, which may satisfy him that the bird had made no mistake.—*F. E. L. Beal, Ag. College, Ames, Iowa.*

NOTES ON SOME FRESH-WATER CRUSTACEA, TOGETHER WITH DESCRIPTIONS OF TWO NEW SPECIES *(Continued).* — *Crangonyx gracilis* Smith. — (*C. gracilis* Smith S. I., Crustacea of the Fresh-waters of the U. S., Report U. S. Fish Commission for 1872–3, 654; S. A. Forbes, Bulletin Illinois Museum Nat. Hist., No. 1, 6.) Numerous specimens of the Western variety of this species were obtained in the ponds and slow streams around Irvington during the winter and early spring of 1879–80. They differ in no appreciable way from specimens of the same species obtained at various localities in Illinois.

Crangonyx mucronatus Forbes.—(*C. mucronatus* Forbes, S. A., Bull. Ills. Mus. Nat. Hist., No. 1, 6.) Two males of this curious species were obtained from a well in Irvington during the latter part of the year 1879. On the anterior edge of the sternal portion of each of the last two thoracic segments, I have observed two appendages, no mention of which is made in the original description cited above. They call to mind the appendages mentioned by Prof. S. I Smith (op. cit. 647) as occurring on some of the anterior segments of *Pontoporeia hoyi.* In form these appendages are elongated, oval, and pointed. They are as long as the branchial sacs, or longer, and seem to be corneous. They may occur on the sternal portion of other of the thoracic segments; but in the very few specimens that I have had the opportunity to examine, I have not observed this.

Asellus communis Say.—(*A. communis* Smith, S. I., op. cit. 657 *A. militaris* Hay, O. P., Bulletin Ills. Mus. Nat. Hist., No. 2, 90.) This species is very common in the streams about Irvington, during the early months of spring. I am now pretty well convinced that the form that I described as cited above is the same as the Eastern species. It differs certainly from Eastern specimens in the armature of the hand, in the form of the genital plates, in size, and in some other respects; but I do not believe that these characters are sufficiently marked and constant to enable us to found species on them. The specimens obtained at Irvington differ in the details of the hand and genital plates from all others that I have seen; but these differences are accompanied by no others of importance. As I now recognize this species, it extends in its distribution from Massachusetts and Connecticut on the east to the Mississippi on the west, and to Central Mississippi on the south. About the middle of August of the present year I

was at Jackson, Miss., collecting fishes and, incidentally, other animals. While engaged in searching in the mud and among the fallen leaves in a pool formed by a spring along the Pearl river, I found some specimens that prove to belong to *Asellus communis*. The individuals are all of small size, none exceeding about 7^{mm} in length. That they are mature, however, is shown by the fact that several of the females bear numerous eggs beneath their oostegites. They appear almost as pigmies beside the Illinois variety, *militaris*. The discovery of these specimens in this locality shows that this species has a very wide geographical distribution.

Mancasellus tenax Harger.—(*Asellus tenax* Smith, S. I., Amer. Jour. Sci., 1871, 453. *Asellopsis tenax* Smith, S. I., Freshwater Crustacea U. S. 659. *Mancasellus tenax* Harger, Amer. Jour. Sci., 1876, 304.) Along with the species of *Asellus* mentioned above as occurring in the neighborhood of Irvington, and in equal abundance, is found *Mancasellus tenax*. It was originally described from specimens obtained about the great lakes of Michigan, and I am not aware that it has hitherto been noticed anywhere else. The specimens that I have collected here apparently belong to Mr. Harger's variety *dilata;* but are in some respects different both from this variety and from the typical forms. The flagellum of the antennæ may have as many as forty-five segments. The propodite of the first thoracic foot is oval, swollen, and armed with three teeth, being in these features like *dilata*, but differing in that the larger tooth is the one at the posterior angle, instead of the middle one. This largest tooth is fully one-third as long as the dactyl. There is a prominent lobe or tooth on the concave side of the dactyl, about the middle of its length. On the outer surface of the mandible I have observed a small tubercle, situated apparently in a slight depression and armed with a hair. This I have been inclined to regard as a rudiment of the mandibular palpus.

Eubranchipus vernalis Verrill.—(*Eubranchipus vernalis* Verrill, A. E. ——— ——— Packard, A. S., Jr., Hayden's Rep. Geolog. and Geog. Sur., 1874, 622.) Large numbers of this crustacean, so interesting on account of its curious form and structure, its habits, its beautiful colors, and its graceful movements, were taken from ponds in Irvington, during the winter of 1879–80. During this period the weather was unusually mild, and the waters remained unfrozen during the greater part of the season. About the first of December I caught a single specimen of what was evidently an Eubranchipus. It was but partially developed, and I supposed that it would turn out to be *E. serratus* Forbes. On the 10th of January I collected several full grown specimens of the same animal in the same pond, and a careful examination showed that they belonged to Professor Verrill's *E. vernalis*. The ponds in which I have taken specimens here are, some of them

at least, dried up every summer. Not many individuals could be captured by merely sweeping the net through the water; but when it was used to stir up the soft mud at the bottom, they could be taken in great numbers. In the March number of Vol. XII. of the AMERICAN NATURALIST occurs a note by Professor A. S. Packard, Jr., stating that this species had been captured at Danvers, Mass., Jan. 10, 1878, and had been seen even earlier. So far as I am aware, no one has hitherto reported this species as having been observed outside of Massachusetts and Connecticut. —*O. P. Hay, Irvington, Ind.*

ALBINISM IN A CRUSTACEAN. — To-day I found under a log an albino specimen of *Porcellio*. It was of a uniform yellowish white color, and was among other sow-bugs of the ordinary gray and brown colors. It is the only one I have ever seen.—*Henry Ward Turner, Ithaca, New York, Dec. 18th, 1881.*

May 23, 1881.

LONGEVITY OF THE TURTLE.—Enclosed I send you a slip cut from "*The Clayton Independent*," published at Clayton, N. Y., Sep. 8th, 1881. The article was copied by some of the local papers in that vicinity, viz: "*Watertown Times*," and "*Watertown Reformer*." For the truth of these statements I can vouch so far as the matter concerns myself. A. D. Percy is a brother-in-law of mine and a gentleman to be relied upon. At the second capture the first markings were not very distinct, but sufficiently so to be easily read. Very truly yours,

C. D. ABBEY,
Principal of the High School, Wausau, Wisconsin.

"In 1864 C. D. Abbey found a large mud turtle on his father's farm, and cut his name and the date on the shell and then put it into the river. In 1874 he found the same turtle near the same place and again cut his name and date in the shell and then released it. Last Friday the same turtle made its appearance, and A. D. Percy cut his name on the back, and placed it in the river, when it started directly for Canada, evidently displeased with such treatment."

HABITS OF THE BORING SPONGE.—N. Nassonon finds, states the Journal of the Royal Microscropical Society, that the Clione lives on the shells of living oysters as well as on empty shells. They give off from the surface very delicate pseudopodia-like processes, which pass in all directions into the substance of the shell; these processes may branch, and even anastomose with one another. The author, by placing in the aquarium fine transparent lamellæ of oyster shells, saw the young Clione push its processes into the calcareous lamellæ; when they had reached a certain depth they united with one another and forced out hemispherical calcareous particles; these were by contraction carried into the interior of the body, and then cast to the exterior. The ectoderm is reported to

consist of flat, colorless epithelial cells, with processes by means of which the cells are connected together; the mesoderm is formed by a mass of layers of oval, yellow cells.

COLOR SENSE IN CRUSTACEA.—M. Paul Bert has made some interesting experiments on a small fresh water crustacean belonging to the genus Daphnia, from which he concludes that they perceive all the colors known to us, being, however, specially sensitive to the yellow and green, and that their limits of vision are the same as ours; but Sir John Lubbock, says the Journal of the Royal Microscopical Society, as the results of his own experiments with Daphnia under different parts of the spectrum, considers that the limits of vision of Daphnia do not, at the violet end of the spectrum, coincide with ours, but that, like the ant, it is affected by the ultra-violet rays.

HAIRS OF THE ANTERIOR ANTENNÆ OF CRUSTACEA.—S. Jourdain, after a few words on the auditory hairs of this group, proceeds to point out the arrangement and structure of the processes found on these antennules, which were regarded by Leydig as having an olfactory function. Before describing the arrangements which obtain in the representatives of different orders, he says that in all cases we find a very delicate chitinous sheath, which is penetrated by an offshoot from the hypodermic layer, and which at its base is found to be in relation with a branch of the antennary nerve; the free end is truncated and carries a hyaline body, which appears to be comparable to the rods found at the sensory ends of sensory organs. These may be known as the "poils á bâtonnet." The hairs are cylindrical in some cases, and then the chitinous cylindrical sheath is made up of a number of joints; the basal ones have thicker walls and are shorter than those which are more distal. In other cases the hairs are *stipitate*, and then the joints are ordinarily reduced to three, and the basal one, which is of some length, is constricted in its middle. A detailed study shows that the former arrangement is confined to the Podophthalmate crustacea; the hairs are found in the young, though in less number than in the adult; and, similarly, they are more numerous in the higher than in the lower forms. Although there seems to be no doubt that these organs respond to stimuli which are something else than tactile, we are not yet in a position to definitely assert that they have an olfactory function. The author concludes by remarking that the characters of these parts have a value for the systematist.—*Journal of the Royal Microscopical Society.*

BYTHINIA TENTACULATA.—My friend, Mr. Henry Prime, has just called my attention to an error in THE NATURALIST for September, 1881 (p. 716), in introduced species of shells. Instead of W. H. Ballou, it should have been W. M. Beauchamp, as in the notice to which reference was made.

Permit me to make a little fuller statement about this shell. I met with it in great numbers at Oswego in June, 1879, and finding no description of an American shell corresponding to it, referred the matter to Dr. James Lewis, who was equally puzzled with myself until he saw the shell. He at once pronounced it a Bythinia, the first he had known in this country, and thought it *B. tentaculata* Linn., but, as it varied locally, he was not sure but it might prove a new and native species. Mr. Tryon at once pronounced it *B. tentaculata*, but it is interesting for comparison with the European shell.

Dr. Lewis had successfully colonized Western mollusks in the Mohawk river and Erie canal, and I sent him several hundreds of this species for that purpose. How they have thriven I do not know. I put some in the Seneca river, but have seen none of them since, and think they require still waters. In the Erie canal at Syracuse, west of the Oswego canal only, there are a good many. At Oswego they adhere to the wooden piers and stones near the mouth of the river, and I found them nowhere else there.

Soon after these shells were brought to Dr. Lewis' notice he showed some of them to Mr. Charles E. Beecher, of the New York State Cabinet, and found that he had frequently observed them in the canals near Albany, but had mistaken them for another native shell. Mr. B. certainly saw them before I did, though I happened to report them first. Dr. Lewis thought this species would spread rapidly, and it seems inclined to follow the canals, but not the streams. In ponds it would probably increase fast. Although it must have reached Oswego and Troy by way of the St. Lawrence, I am unable to learn of its presence on that river, or in Lake Champlain.—*W. M. Beauchamp.*

Zoological Notes.—The species of orangs, which have been placed at from one to four, have been examined by Mr. F. O. Lucas, of Professor Ward's establishment, who reports in the Proceedings of the Boston Society of Natural History that all four forms must be referred to one.——Professor Ward has returned from a collecting journey to New Zealand and Australia with a large collection of marsupials, Ornithorhynchus, specimens of Echidna from New Guinea, and of Hatteria from New Zealand. His account of the habits of the latter very rare lizard, given in Ward's Natural Science Bulletin for January 1, is well worth reading.——The mollusca of H. M. S. *Challenger* are being described in the Journal of the Linnæan Society, London, in a a series of papers, by Rev. R. B. Watson, of which we have thus far received eight parts. The deep sea mollusks of the Gulf of Mexico and the Caribbean sea obtained by the U. S. Coast Survey steamer *Blake* have been described by Mr. W. H. Dall in Bulletin No. 11, Vol. IX, of the Museum of Comparative Zoölogy, at Cambridge, Mass. The collections made by the *Blake* in one winter

(1877–78) is very rich, containing perhaps three times as many species as the results of the whole three years' voyage of the *Challenger*.

ENTOMOLOGY.[1]

LIST OF NORTH AMERICAN CYNIPIDÆ.

Genus 4. RHODITES Hartig.
verna O. S.
radicum O. S.
bicolor Harris.
dichlocans Harris.

Genus 9. PERICLISTIS Forst
sylvestris O. S.
= *Aulax sylvestris* O. S.
pirata O. S.
= *Aulax pirata* O. S.

Genus 12. SYNERGUS Hartig.
lignicola O. S.

Genus 15. DIASTROPHUS Hartig.
nebulosus O. S.
radicum Bass.
cucutæformis O. S.
potentillæ Bass.

Genus 17. ANDRICUS Hartig.
singularis B.
Osten-Sackenii B.
ignotus B.
californicus B.
concinnus B.
capsula B.
acinosus B.
petiolicola B.
flocci Walsh.
tubicola O. S.
sub. gen. CALLIRHYTIS Forst.
agrifoliæ B.
cornigera O. S.
Suttoni B.
punctata B.
seminator H.
sub. gen. CALLIRHYTIS Forst.
similis B.
futilis O. S.
tumifica O. S.
scitula B.
clavula B.
operator O. S.
palustris O. S.?

Genus 18. CYNIPS (L.) Hertig.
strobilana O. S.

Genus 20. ACRASPIS Mayr, nov. gen.
pezomachoides O.S.
erinacei Walsh.

Genus 22. BIORHIZA Westwood.
forticornis Walsh.

Genus 25. LOXAULIS Mayr, nov. gen.
mammula B.

Genus 27. HOLCASPIS Mayr, nov. gen.
globulus Fitch
duricoria B.
rugosa B.

Genus 28. DRYOPHANTA Forst.
gemula B.
nubila B.
bella B.
polita B.?

Genus 29. NEUROTERUS Hartig.
batatus B.
noxiosus B.
vesicula B.
majalis B.
minutus B.
floccosus B.
Rileyi B.

BIBLIOGRAPHY OF GALL LITERATURE.—The study of galls belongs to the domain of entomology as well as botany, and no one is more capable of reviewing the literature on the subject than Dr. Fr. Thomas, of Ohrdruf (Germany). Dr. Thomas has for some years past prepared the chapter, "Durch Thiere erzeugte Pflanzengallen" (Galls produced on plants by animals) of the Botanischer Jahresbericht, and we have just received his report from Vol. VII of that periodical. This latest record comprises the literature of the year 1879, including a few publications of the year 1878, not mentioned in the Jahresbericht for 1878, and is arranged as in the previous volumes; the titles are first given alphabetically by authors, a key to the subjects treated

[1] This department is edited by PROF. C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.

of follows, and finally the review is given of the publications. There are 107 publications recorded in this volume, of which number more than one-third treat directly or indirectly of the grape Phylloxera. The record is an evidence of the increasing interest felt in this branch of natural history. The most important contribution of the year 1879 appears to have been L. Courchet's "Etude sur les galles produites par les Aphidiens."

A NEW DEPREDATOR INFESTING WHEAT-STALKS.—Under the title of *Isosoma allynii*, Professor G. H. French, of Carbondale, Ill., describes what he believes to be a new wheat pest, in the *Prairie Farmer*, for Dec. 31, 1881. He has been kind enough to send us types of this new species, which, as we suspected from the description, prove to be not Isosoma, but a species of Eupelmus parasitic doubtless on some of the wheat-stalk feeders and probably on some species of Chlorops. A detailed description published in the *Canadian Entomologist* (Jan., 1882) of this "*Isosoma allynii*," shows also that Professor French drew it from the Eupelmus. The error would have less significance but for the existence of a true Isosoma affecting wheat much in the manner related by him, and undescribed.

We have been studying this last insect for nearly two years past from specimens received from Tennessee and Missouri. The larvæ were first received in June, 1880, passed the winter in the pupa state, and issued as adults in March and April, 1881. Specimens received the present season have issued in December, induced doubtless by the long protracted warm weather which generally prevailed in those sections. Although congeneric with the Joint-worm (*Isosoma hordei*) of Harris and Fitch, it differs widely from the latter in habits and appearance. The Joint-worm forms a gall-like swelling at a joint near the base of the stalk, while the species under consideration feeds on the interior of the stalk between the joints higher up without causing a swelling. The adult insect is more slender and much more hirsute than is the joint-worm fly, and is perfectly smooth upon the dorsum of the thorax, while the latter presents a marked punctation; moreover, the customary pronotal spot in the new species is large and yellow, while in *hordei* it is almost indistinguishable. We have recently characterized the insect in the *Rural New Yorker*, and append the following description:

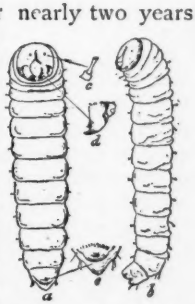

FIG. 1.—Larva of *Isosoma tritici* Riley. *a*, ventral view; *b*, side view; *c*, antenna; *d*, mandible; *e*, anal joint beneath.

ISOSOMA TRITICI, n. sp. *Female.*—Length of body, 2.8 mm. Expanse of wings, 4 mm. Greatest width of front wing, 0.7 mm. Antennæ subclavate, ¾ the length of thorax. Whole body (with the exception of metanotum which is finely punctulate) highly polished, smooth and sparsely covered with long hairs most dense toward

end of abdomen. Color, pitchy-black without metallic luster, the scape of antennæ, occasionally a small patch on the cheek; mesoscutum, femoro-tibial articulations and tarsi (except last joint) tawny; pronotal spot large, oval and pale yellowish in color. Wing veins, dusky-yellow, and extending to beyond middle of wing; submarginal three times as long as the marginal, postmarginal very slightly shorter than marginal, and stigmal also shorter than marginal.

Described from 24 ♀ specimens; ♂ unknown. Of these 24 specimens only one was fully winged, two were furnished with hind wings only, while the rest were wingless.

It is worthy of remark that the species seems to be quite closely related to the European *Isosoma linearis*. This species was bred from wheat by Dr. Giraud, who considered it inquilinous in the swellings formed by the Dipterous *Octhiphila polystigma* of Meigen. Kaltenbach remarks, however, that although obtaining the Isosoma many times from the wheat, he never succeeded in seeing the Dipteron—a very suggestive fact.

Walker (Notes on Chalcididæ, p. 7) states, in reference to the "humeral spot" that although present in all European species of Isosoma, it is absent in American and Australian representatives of the genus. In *tritici*, however, it is a prominent feature of the markings, and even in *hordei* it is as evident as upon the European *I. verticellata* which we have from Walker himself.—*C. V. Riley.*

FURTHER NOTES ON THE IMPORTED CLOVER-LEAF WEEVIL *(Phytonomus punctatus).*—During a recent visit to our friend, Dr. LeConte, in Philadelphia, we learned that he had received a beetle from Canada, as long ago as 1853, from Mr. D'Urban, who was then connected with the geological survey of that country, and another specimen from the late Dr. Melsheimer, from Pennsylvania, and that these specimens had been described by him as *Phytonomus opimus* (Rhynchophora, p. 124). He had recognized, from what we had published in the NATURALIST, regarding *Phytonomus punctatus,* that his *opimus* was identical, and upon receiving specimens from us he wrote that after a careful examination there was no doubt in his mind as to the identity of the two species. *Ph. punctatus,* in its typical and most common form, is so easily recognizable by its coloration (the suture and margins of the elytra being yellowish-white) that one would not suspect its identity with *Ph. opimus* from the description of this last. It would appear, however, that *opimus* is identical with a variety of *Ph. punctatus* described by Capiomont *(Annales de la Société Entomologique de France,* 1868, p. 123), in which the scales of the elytra are almost uniformly gray, and which is not rare in Europe. The specimen from Melsheimer is, moreover, evidently rubbed. It is a strange coincidence that the numerous specimens we collected on Mr. Snook's farm were all identical in coloration with the typical form, and that just those described by Dr. LeConte as *opimus* should belong to a comparatively rare form.

The identity of the two forms once established, it becomes probable that the insect had made a permanent lodgement in this country years ago, and that it was simply overlooked as an injuri-

ous insect till the present year. That a beetle is quite liable to be overlooked by coleopterists, although quite injurious to some cultivated plants, is not only probable, but has often occurred. *Coccotorus scutellaris* which injuriously affects the plum; *Tylo-derma fragariæ* which depredates on the strawberry plant; and *Hylesinus trifolii* which is so injurious to clover, are examples among many which occur to us of species very common on cultivated plants, yet rare in collections. The same is equally true in other orders of insects. A notable instance is found in the Hessian fly which, though more or less injurious every year in some of our wheat-producing sections, is yet so rare in collections that Dr. Packard had difficulty in procuring specimens to figure for his bulletin on the species.

There is the other alternative, however (which is also not so improbable), that the two specimens that have remained solitary so many years in the largest American collection of Coleoptera, may really have come into the country through European exchanges, especially as it is known that Dr. Melsheimer did, in some instances, mix up European with American species.

It is impossible to say whether this Phytonomus will spread further west or not. The encouraging presumption, however, is, if we may predicate upon analogy, that it will not, since we recall no very injurious beetle introduced from Europe (excluding those feeding upon stored products) which has spread over the whole country, the most prominent examples of such introduced species, *Crioceris asparagi*, *Galeruca xanthomelæna*, etc., being yet confined to the Atlantic coast.

Our experience and observations this winter confirm the opinion already expressed, that this Phytonomus hibernates principally in the young larva state, and that any mode of winter warfare that would crush or burn these larvæ hibernating in the old stalks would materially reduce the depredations of the species the ensuing summer. Clover stubble is, however, not so easily burned in winter, and whether rolling could be advantageously employed will depend very much on the smoothness of the field and other conditions.

As an interesting fact in connection with imported clover enemies we would mention that several species of the Curculionid genus Sitones, especially *S. flavescens* and *lineellus*, which in Europe are injurious to clover and lucern, and which have long since become naturalized in our country, have never been reported here as injurious though they occur quite commonly in some localities.[1]—*C. V. Riley.*

Silk-worm Eggs; Prices and where obtained.—We daily receive applications for silk-worm eggs and inquiries as to where

[1] *Sitones tibialis*, in Europe is a dangerous enemy to young peas, and though likewise introduced into the United States and Canada, does not appear to be injurious in either.

they can be obtained, the number of such applications indicating that interest in silk culture is fast increasing through the country. A small supply of silk-worm eggs will probably be at the disposal of the Department of Agriculture early this spring, and will be distributed upon application. We learn also, from circulars received from Crozier & Co., Bayou Sara, La., that they are prepared to furnish eggs at the following prices: Annual Japanese, $5 per ounce, $1 per 1000 eggs; the best yellow breed, warranted free from disease, $6 per ounce, $1 per 1000. The eggs ought to be ordered early, or else there is great danger of their hatching prematurely while on the way. A few eggs of a special race, fed for eleven years on osage orange *(Maclura aurantiaca)* by the editor, will be sent to a limited number of applicants who desire to feed with this plant, upon application to him.

ANTHROPOLOGY.[1]

PROFESSOR RAU ON CUP-SHAPED STONES.—The distinguished curator of the archæological treasures of the National Museum has just published a paper upon cup-shaped and other lapidarian sculptures in the Old World and in America, which will form a part of Volume V. in Major Powell's series of Contributions to North American Ethnology. This monograph is in 4to, and consists of 102 pages of printed matter, illustrated by 61 figures on tinted paper.

In archæology, as in natural history, form and function have to be studied separately, and each class of objects may be considered from the point of view of either. Furthermore, in all anthropological investigations analogies are to be distinguished from homologies. The work under consideration treats of a certain form in ancient sculpture, occurring in very interesting connections in various parts of the world, viz., certain cup-shaped excavations called *pierres à écuelles* in French, and *Schalensteine* in German. Part I. is taken up with a comprehensive review of the work of Professor E. Desor, entitled "Les Pierres à Ecuelles" (Genève, 1878); that of Sir James Y. Simpson entitled "Archaic Sculptures of Cups, Circles, &c., upon Stones and Rocks in Scotland, England, and other Countries" (Proc. Soc. Antiq., Scotland, 1867); Mr. J. H. Rivett-Carnac's "Prehistoric Remains in Central India" (Calcutta, 1879); and scattered references to these sculptures occurring in Scotland, England, Ireland, France, Switzerland, Germany, Austria, Denmark, Sweden, and India. One-half of the illustrations are taken from the works above mentioned.

Professor Rau is very careful, while describing and figuring excavations very similar in form and grouping, to keep in view the fact that slight differences in detail combined with great differences of location may point to widely separated functions. In-

[1] Edited by Professor OTIS T. MASON, 1305 Q. street, N. W., Washington, D. C.

deed the *mahadeos* and *yonis* of India can hardly be said to have had their counterparts in America.

While the first part of the volume exhibits a vast deal of research and painstaking, the truly original portion and that for which a lasting obligation will be due the author, is Part II., relating to cup-cuttings in America. These sculptures occur on hammer-stones, boulders of various sizes, paint mortars, stationary mortars, &c. They are not all alike in execution; some are single, others in groups. The Professor, both in his descriptive portion and in the closing remarks, enters quite minutely into the discussion of functions, and a few of his conclusions are herewith given:

I. The so-called hammer-stones were not flint nappers; many of them show no mark of use as hammers. There is great probability that they were nut-crackers.

II. Many of the pitted boulders were paint mortars, and those with several pits have their analogues in the compound paint cups of the Pueblo Indians.

III. They were not anvils for shaping copper disks.

IV. They were not spindle sockets. Following this discussion is an extended allusion to several large pitted stones, notably one found by Dr. H. H. Hill, of Cincinnati.

V. The deep depressions in large rocks were stationary mortars.

VI. Certain sculptures found in Pennsylvania and elsewhere resemble the cup and ring cuttings of the Old World.

In Part III. Professor Rau discusses the significance of cup-shaped and other primitive sculptures, giving particular attention to Professor Nillson's "Phœnician Baal-worship theory," Canon Greenwell's "map theory," Professor Simpson's "dial theory," and many other speculations. The author is very much inclined to admit Mr. Rivett-Carnac's views respecting the "reciprocal principle" in many European examples. The question as to the authorship of the sculptures is also considered, as well as the superstitions connected with them, and the evidence afforded by them of migrations from the Old World to the New.

MEXICAN ANTHROPOLOGY.—The fourth and fifth parts of *Anales del Museo Nacional de Mexico* contain the following papers relative to this department:

Codice Mendozino: Ensayo de descrifacion geroglifica, por el Sr. D. Manuel Orozco y Berra. (Continuacion) pp. 223–232.

La Piedra del Sol: Estudio arqueologico, por L. Sr. D. Alfredo Chavero. (Continuacion) pp. 234–266; 291.

Mitos de los Nahoas, por el Director del Museo, Sr. D. Gumesindo Mendoza. pp. 271–278; 315–322.

Dos Antiguos Monumentos de Arquitectura Mexicana, ilustrados por el P. Pedro José Marquez. Tracudido para los "Anales del Museo," por F. P. T. pp. 279–290.

Anales de Cuauhtitlan, appendix, 33–40; 41–48.

THE IMPLEMENTS OF THE TRENTON GRAVELS.—Mr. Henry W. Haynes, of Boston, read a paper before the Boston Society of Natural History last January upon the argillite implements found in the gravels of the Delaware river, &c., compared with the palæolithic implements of Europe. The communication is published in Vol. XXI of the Proceedings. The author comes to the following conclusions: The objects have come from the gravel beds of the Delaware valley, and only occasionally have they been found upon the surface. They show incontestable marks of human workmanship. The general appearance of the country is similar to that of the palæolithic gravels of the Old World. Dr. Abbott has sent us a pamphlet reprint from the Society's Proceedings reviewing the whole subject.

ANTIQUITIES OF NEW MEXICO AND ARIZONA.—Dr. W. J. Hoffman, of the Bureau of Ethnology at Washington, sends us a revised edition of a pamphlet on the above named subject, which first appeared in the Proceedings of the Davenport Academy of Natural Sciences. The author has had a great deal of experience in the Indian country as a physician, is a man of great tact and address, and has been connected with the government surveys for a long time. We have in the brochure before us an excellent epitome of our knowledge of the Pueblos. The subject of glazed pottery is treated at length and several analyses given. On the subject of crania and deformations the treatise is especially full and the bibliography invaluable.

ASIATIC TRIBES IN NORTH AMERICA.—From the Proceedings of the Canadian Institute, we are in receipt of a brochure of 38 pages from the pen of Professor John Campbell, on the Asiatic Tribes of North America. In this the author indicates the origin of three Indian families: the Tinneh or Athabascans, the Iroquois, and the Choctaws. The Tinneh family are associated with the Tungusians of Siberia and Northern China, and the Iroquois and Choctaws (who with the Cherokees are simply disguised Iroquois) with the populations of Northeastern Asia, classed by Dr. Latham as Peninsular Mongolidæ. With respect to the Tinneh, Professor Campbell, at the close of his argument remarks, "Certainly, no two families representing the Old World and the New present closer affinities in name, vocabulary, grammar, physical appearance, dress, arts, manners and customs, than do the Tungus of Asia and the Tinneh of America."

Under the term Choctaw is included the entire Muscogee family, together with the Cherokees, the Choctaws representing the Tehuktchi or Tshekts, and the Cherokees the Koriaks or Koraeki. The Tuscaroras of the South are taken as the oldest and purest form of the Wyandot-Iroquois and through them the last named family are brought into relationship with the Choctaw-Cherokee, and by this path with the Koriak in Northeastern Asia.

ANTHROPOLOGY IN FRANCE.—The unusual amount of matter relating to our own country precludes giving more than a brief outline of what is doing abroad. The *Bulletins de la Société d' Anthropologie de Paris* reports the following discussions in the 1st fasciculus for 1881:

Bordier, M.—Calotte cérébrale d'un Esquimau, p. 16.
Chudzinski, M.—Splanchnologie d'un orang, p. 19.
Vinson, Jules.—Procédé de calcul du jeune Jacques Inaudi.
Soldi, Emile.—De l'emploi du fer en Egypte pendant les premières dynasties, p. 34.
Tenkate, H. F. C.—Crânes de musée de Leyde, p. 37.
De Torok, A.—Crâne du jeune gorille de musée Broca, p. 46.
Bordier, A.—Rapport sur un mémoire de M. Petitot, p. 57.
Hayem, Professor.—Du sang au point de vue anthropologique, p. 72.
Millet, —.—Menhirs et bassins taillés dans le grès en Algérie.
Rabourdin, Lucien.—Age de pierre dans le Sahara central, pp. 115–160,

The Revue d'Anthropologie, vol. IV., part IV., contains the following original papers and reviews:

Broca, Paul.—La torsion de l'Humerus et le tropomètre, p. 577.
Quatrefages, M. de.—Les voyages de Moncatch-Apé, p. 593.
Ledouble, M.—Sur certain muscles communs aux animaux et a l'homme, p. 635.
Nadaillac, M. de.—La poterie chez les anciens habitants de l'Amérique, p. 639.
Hervé, Georges.—Du poids de l'encéphale, pp. 681–698. [A review of "Das Hirngewicht des Menschen; eine Studie," von Th. von Bischoff, Bonn, 1880, and "Sul peso del cervello dell'uomo," studio di Giustiniano Nicolucci, Napoli, 1881.]
Zabarowski, —.—Revue prehistorique. [Includes the following works: Emile Soldi's "Les arts méconnus;" Dr. Nehrings's "Nouvelles fouilles dans le diluvium de Thiede," and other works of a more local character.]
Topinard, Paul.—Revue des livres. [Résumé of recent literature upon the aborigines of Australia.]
Manouvrier, L.—Review of French and Italian journals.
Deniker, —.—Review of Dr. Hortel's "De la queue chez l'homme."
Vars, Ed.—Revue russe. [Examines M. Bogdanoff's craniological works.]

At the close of the number is an extended bibliography, too long to be reproduced here; but the important titles will appear in the next Smithsonian Annual Report.

CORRECTION.—By an oversight, for which we are extremely sorry, the title of the paper by Professor Cyrus Thomas on the Manuscript Troano, read at the American Association, was omitted from the list.

GEOLOGY AND PALÆONTOLOGY.

MARSH ON THE CLASSIFICATION OF THE DINOSAURIA. — Professor Marsh regards the group as a sub-class, and divides it into five orders, viz.; *Sauropoda*, *Stegosauria*, *Ornithopoda*, *Theropoda* and *Hallopoda*; the first three herbivorous, the last carnivorous. The *Sauropoda* include *Atlantosaurus*, *Camarasaurus*, *Cetiosaurus* and other forms having five digits on each of the limbs, and limbs nearly equal; *Scelidosaurus*, *Hylæosaurus* and others having also twenty digits, but with small fore limbs and a post-pubis, form the order *Stegosauria; Camptonotus*, *Laosaurus*, *Iguanodon*, etc., having five digits in manus and three in pes, with small fore limbs, are included in the *Ornithopoda;* while *Megalosaurus*, *Altosaurus*, *Zanc-*

lodon, *Amphisaurus*, and other species with digitigrade feet, small fore limbs, and prehensile claws, form the order *Theropoda*, which has also two sub-orders—*Cœluria* and *Campsognatha*. The *Hallopoda* are doubtfully referred to the sub-class, and have the hind feet specially adapted for leaping.

In the preparation of his papers on this subject Professor Marsh has had very extensive material, and has had excellent opportunities for investigation. He had added more to our knowledge of this division of reptiles than perhaps any other single person. His demonstration of the structure of the pelvis in various genera, of the feet in many forms, including *Campsognathus*, and the discovery of the clavicle in *Iguanodon* and other genera, are among the most important points gained. It is, however, not evident that the Dinosauria constitute a group of higher rank than an order, or that the subdivisions proposed by Professor Marsh are of higher rank than sub-orders or families.

The "personal equation" is observable in this work, in as marked a degree as in any of Professor Marsh's papers. This is is seen—

First. In his failure to characterize his genera on first publishing them—a proceeding which is apparently intended to warn others off the field. The publication of *nomina nuda*, without the definitions which enable others to use them, is, to say the least, very inconvenient to cotemporary students.

Second. In his failure to recognize the labors of others, except to point out supposed errors. Thus three of his orders had received names long before Professor Marsh wrote, and had been defined, less completely, it is true, but, as far as the material went, correctly. Thus his Sauropoda was named by Owen, in 1841, *Opisthocœla;* his Ornithopoda by Cope, in 1869, *Orthopoda;* and his Theropoda by Cope, in 1869, *Goniopoda*. The numerous genera described from the American Jurassic by American authors, are all ignored or stated to be founded on error.[1] Some of them are identical with those proposed by Marsh, and of earlier date.

Thirdly. In his failure to credit others with their discoveries, and permission of the inference that they are his own. Such is the discovery of the hyposphen articulation, by Cope, which he renames the diplosphen. Such is the discovery of the sternum in the Dinosauria, which was made by Cope in the Laramie genus *Monoclonius* in 1877 (Proceedings Philadelphia Academy). His reference of some discoveries to other than their authors is not less frequent. Thus it is well known that Professor Cope first showed the bird-like affinities of some of the Dinosauria, and affirmed

[1] As *e. g.*, *Amphicœlias* Cope, which Marsh states, in effect, was founded on the characters which belong to lumbar vertebræ of other genera, ignoring the fact that other distinctive characters were given at the same time, which are entirely sufficient.

that the bird-like tracks of the Triassic formation were made by Dinosauria, at least a year before Professor Huxley; yet these observations are credited to the latter writer.

It cannot be said in defence of these defects in an otherwise excellent memoir, that the papers in question have been written by Professor Marsh's assistants, since the latter are not made responsible on the title-page.—*E. D. Cope.*

THE DINOSAURS OF BERNISSART[1].—In the year 1878 numerous bones of fossil reptilia were discovered in the St. Barbe mine of the Bernissart coal district, and ultimately several Iguanodon skeletons were taken out from a depth of three hundred and fifty metres, as complete and almost as well preserved as though they had come straight from a slaughter-house. In a notice submitted to the Royal Academy of Belgium, M. Boulenger founds a new species on these skeletons, on account of their possession of six sacral vertebræ instead of five, the number possessed by that in the British Museum. M. P-J. Van Beneden, however, in reviewing M. Boulenger's work, states his belief that the remains belong to the well-known *I. mantelli* of England and Western Europe, and that the difference in the number of sacral vertebræ is merely an individual one. In support of this opinion he cites the facts that another Iguanodon, described by M. Hulke, has only four sacrals, and that the number of sacrals is subject to variation in many animals, especially in birds, the additional ones being taken from the caudal or the lumbar series.

M. Dupont has also written upon the Bernissart Iguanodons, and agrees with M. Van Beneden in referring them to *I. mantelli.* M. Van Beneden adds some interesting particulars relating to the limbs and pelvic arch of Iguanodon.

All palæontologists agree that the Iguanodons had on the hind feet three toes used in walking, but it is not generally known that the metatarsal bones of these three toes were completely separate, alike at both ends, and capable of leaving their imprint upon the soil behind the toes, so that the Iguanodons were plantigrade when compared with most birds, or, to speak more accurately, were *herpetigrade*, like the penguin's.

The fore limbs, which are as little developed as in kangaroos, have five fingers; three middle ones equally developed and having three phalanges, as also has the fifth, and a thumb consisting of a single large phalanx and a rudimentary metacarpal. The fifth finger is small, and opposable to the thumb, so that the Iguanodons had two hands with which to gather the fruits of the cycads and conifers that flourished in the same epoch.

The impressions of the footsteps of these animals, well preserved

[1]Sur l'Arc Pelvien des Dinosauriens de Bernissart; par M. G. A. Boulenger. Rapport de M. P-J. Van Beneden. Bruxelles. Imprimerie de l'Academie Royale de Belgique, 1881.

both in England and in Hanover, teach us that they did not make use of their tail for support, either when walking or when at rest, since up to this time no trace of a caudal impression has been found. This is also what might be inferred from the structure of the processes of the caudal vertebræ and from the tendons, which are so distinctly ossified that with a little trouble the myology of the tail could be made out.

There has been considerable difference of opinion among naturalists as to the homologies of the pelvic bones of saurians, especially with regard to the pubis, which is incomplete and does not take part in the formation of the cotyloid cavity. The pelvic basin of *Comptonotus dispar* (Marsh) is, according to that author, nearest to that of the Iguanodon, but has the post-pubis more bird-like than in the latter.

HULKE ON POLACANTHUS FOXI[1].—Dr. J. M. Hulke has at last given us a description of this species, whose name has been on our lists for some years, but of which it has been impossible to get any information. In proper concession to mnemonic convenience Dr. Hulke has adopted the name given without description by Professor Owen, but the species will stand *Polacanthus foxi* Hulke. The animal is nearly allied to *Hylæosaurus*, and is one of the most thoroughly defended of the Dinosauria. Its body supported huge spines, and its tail was enclosed in an armor of bony plates. The species was large and powerful, but not one of the gigantic forms of the order. It was found in the Wealden of the Isle of Wight by Dr. Fox, who has made so many important discoveries in that region.

RUSSIAN SAUROPTERYGIA.—M. Kiprijanoff has communicated an important memoir on the genus *Ichthyosaurus* to the Imperial Academy of St. Petersburg[2]. The motive for the memoir was found in the discovery of the genus in the Cretaceous greensand of European Russia. This threw the genus into a later geological epoch than its range in Continental Europe had included. The author takes occasion to analyze the species of the genus, a work which will be of great service to extra-European palæontologists in their studies. The Russian species is the *I. campylodon* of Carter. Besides describing the bones of the skeleton, M. Kiprijanoff investigates their histology, and especially the minute structure of the teeth. The plates illustrating this part of the subject are beautiful specimens of art.

THE GEOLOGY OF FLORIDA.—Prof. E. A. Smith, of Alabama, summarizes the geological history of the Peninsula of Florida as follows:

(1.) Since no rocks have been found in Florida older than the

[1]From the Transactions of the Royal Society, London. Part III, 1881.

[2]Studien ueber die Fossillen Reptilien, Russlands von M. Kiprijanoff. 1 Theil, Galiieng Ichthyosaurus. Mem. de l'Academie Imperiale de Sciences de St. Petersbourg. 1881.

Vicksburg limestone, it follows that until the end of the Eocene period, this part of our country had not yet been added to the firm lands of the continent, but was still submerged.

(2.) During the period of disturbance which followed the deposition of the Vicksburg limestone, Florida was elevated nearly to its present height above the sea-level, which elevation was maintained without material interruption until the Champlain period.

(3.) In this upward movement the axis of elevation did not coincide with the present main dividing ridge of the peninsula, but lay considerably to the westward, probably occupying the position very nearly of the western coast of to-day.

(4.) After the Miocene (or possibly the Pliocene) period, there was again an elevation of Florida, as is shown by the presence of a Miocene limestone of the eastern slope of the peninsula, some distance (not less than thirty feet) above the present sea-level.

(5.) We have evidence in the distribution of the beds of the Champlain period (stratified drift of orange sand) that Florida and parts of the adjacent States were during this time submerged sufficiently to allow the deposition over them of a mass of pebbles, sand and clay, varying in thickness from a few feet to two hundred. From the peculiar mode of stratification of most of these beds, it is concluded, with reason, that they were sediments from rapidly-flowing, ever-varying currents. In the State, the beds of yellow and red loam lie directly upon the stratified drift. These beds of loam are devoid of stratified structure, as well as of fossils, and were probably deposited from slowly running or nearly stagnant waters.

(6.) Following the submergence during the Champlain period, was a re-elevation, which brought the peninsula to approximately its present configuration.—*Scientific News.*

GEOLOGICAL NEWS.—The Trans. N. Y. Acad. of Sciences contain a paper by Mr. J. H. Purman upon the "Geology of the Copper Region of Northern Texas and the Indian Territory," giving the first accurate description of the geological structure of the district.——S. A. Miller (Jour. Cincin. Soc. Nat. Hist.) concludes his article on Mesozoic and Cænozoic Geology by considering the "Drift of the Central Part of the Continent." He describes the character of these deposits, their situation, altitude, magnetic bearings, fossils, etc., and concludes by the assertion that the facts collected tend to prove that "there is no marine or other deposit which represents a glacial period." In a second paper he describes two new crinoids from the Niagara group, and two new shells.—— In the Geneva Archives des Sci. Phys. et Nat., July, 1881, Mr. F. A. Forel has an important article on the periodical variations of glaciers, based upon observations in the Alps. The Rhone glacier has retreated from 1857 to 1880 at a rate varying from twenty-

three to seventy-one metres annually. The retreat or advance of a glacier depends "on changes of long periodicity in meteorological conditions—heat, moisture, winds."——In the *Am. Journal of Science* Dr. R. W. Coppinger has some interesting observations upon the movement of the soil-cap on the shores of Western Patagonia. Evergreen forests and brushwood cover the shore hills to a height of one thousand feet, and gravitation, acting on this mass of vegetation and the soil beneath, resting on a surface already planed by ice-action, causes the whole to slide downward to the water, which removes its free edge in much the same way that the end of a Greenland glacier is removed.——The Report on the Geological and Natural History Survey of Minnesota, for 1880, contains a descriptive list of rocks, descriptions of three new Lower Silurian Brachiopods, and a note on the Cupriferous series by Professor Winchell; also an account of the Glacial phenomena of the State and the district north and west of it, by Warren Upham.

GEOGRAPHY AND TRAVELS.[1]

DR. LENZ ON THE SAHARA.—Dr. Oscar Lenz gives in the last number of the *Zeitschrift* of the Berlin Geographical Society[2] an account of the results of his journey across the Sahara, from Tanger to Timbuktu, and thence to Senegambia. The following good abridgement of his paper we take from the *Nature:*

"The real journey was begun at Marrakesh, at the northern foot of the Atlas mountains, where Dr. Lenz laid in his store of provisions and changed his name and dress, traveling further under the disguise of a Turkish military surgeon. He crossed the Atlas and the Anti-Atlas in a south-western direction. The Atlas consists, first, of a series of low hills belonging to the Tertiary and Cretaceous formations, then of a wide plateau of red sandstone, probably Triassic, and of the chief range, which consists of clay-slates with extensive iron ores. The pass of Bibanan is 1250 metres above the sea-level, and it is surrounded with peaks about 4000 metres high, whilst the Wad Sus valley at its foot is but 150 metres above the sea. The Anti-Atlas consists of Palæozoic strata. On May 5, 1880, Dr. Lenz reached Tenduf, a small town founded some thirty years ago, and promising to acquire great importance as a station for caravans. The northern part of the Sahara is a plateau 400 metres high, consisting of horizontal Devonian strata which contain numerous fossils. On May 15 Dr. Lenz crossed the moving sand-dunes of Igidi, a wide tract where he observed the interesting phenomenon of musical sand, a sound like that of a trumpet being produced by the friction of the small grains of quartz. But amidst these moving dunes it is

[1] Edited by ELLIS H. YARNALL, Philadelphia.

[2] Kurzer Bericht über meine Reise von Tanger nach Timbuktu und Senegambien. Von Dr. Oscar Lenz. *Zeitschrift der Gesellschaft für Erdkunde zu Berlin.* Nos. 94, 95, p. 272. It is accompanied by a large map of his route. Scale 1 : 1,500,000. Drawn by Dr. R. Kiepert.

not uncommon to find some grazing places for camels, as well as flocks of gazelles and antelopes. At El Eglab Dr. Lenz found granite and porphyry, and was fortunate enough to have rain. Thence the character of the desert becomes more varied, the route crossing sometimes sandy and sometimes stony tracts or sand-dunes, with several dry river beds running east and west between them. On May 29 he reached the salt works of Taudeni and visited the ruins of a very ancient town where numerous stone implements have been found. Here he crossed a depression of the desert only 145 to 170 metres high, while the remainder of the desert usually reaches as much as 250 to 300 metres above the sea level; and he remarks that throughout his journey he did not meet with depressions below the sea-level. The schemes for flooding the Sahara are therefore hopeless and misleading. The landscape remained the same until the wide Alfa fields which extend north of Arauan. This little town is situated amidst sand-dunes devoid of vegetation, owing to the hot southern winds. Four days later Dr. Lenz was in Timbuktu, whence he proceeded west to St. Louis. During his forty-three days' travel through the Sahara Dr. Lenz observed that the temperature was not excessive; it usually was from 34° to 36° Celsius, and only in the Igidi region it reached 45°. The wind blew mostly from north-west, and it was only south of Taudeni that the traveler experienced the hot south winds [*edrash*] of the desert. As to the theory of north-eastern trade winds being the cause of the formation of the desert, Dr. Lenz remarks that he never observed such a wind, nor did his men; it must be stopped by the hilly tracts of the north.

"Another important remark of Dr. Lenz is what he makes with respect to the frequent description of the Sahara as a sea-bed. Of course it was under the sea, but during the Devonian, Cretaceous and Tertiary periods; as to the sand which covers it now, it has nothing to do with the sea; it is the product of the destruction of sandstones by atmospheric agencies. Northern Africa was not always a desert, and the causes of its being so now must be sought for, not in geological but in meterological influences."

Arctic Exploration.—Up to the middle of June last the edge of the ice extended in an east and west direction at a distance of only sixty to one hundred miles from the coast of Finmark. It trended north-eastward toward Novaya Zemlya, and swept round at a distance of about thirty miles from Matyushin Strait, towards the entrance of the White Sea. With the probable exception of 1867, the ice was then nearer to the northern coast of Norway than it was ever known to be before. After the middle of August the ice disappeared off Novaya Zemlya, and there was probably open water to Franz-Josef Land. It is stated in the Royal Geographical Societies' *Proceedings* that "the collective evidence shows that the prevailing northerly and north-westerly winds of last winter packed the ice in a broad belt across the Spitzbergen and Barent's Seas.

The southern edge of this belt was exceptionally low down along the north coast of Norway, while the northern edge nearly reached the south point of Spitzbergen. The southern pack-edge showed little alteration during May and June, but gave way rapidly when it fairly began to melt—about the beginning of July—as the ice was on the whole of no great thickness. The climatic conditions north and south of the belt seems to have differed considerably during the winter. In the north of Norway heavy falls of snow were unusually frequent, while north of the belt the fall was comparatively slight. So early as the end of June the winter snow had in great measure disappeared even from the highlands of Spitzbergen and Novaya Zemlya, while in the northern part of Norway it lay thickly, down to the very water's edge. On arriving at Spitzbergen the walrus hunters also found vegetation unusually far advanced. Thus since large masses of ice were blown southward during the winter of 1880–1, it is highly probable that the Polar regions were fairly free from ice early in the summer, while the autumn must have offered exceptionally favorable conditions for an advance to the northward or north-eastward. This supposition is strongly confirmed by reports from the walrus grounds northward of Spitzbergen. With regard to the Kara Sea, it seems that it was not accessible from the westward till about the beginning of August. But while a heavy, solid pack extended northward from the Kara Strait along the east coast of Novaya Zemlya, the eastern part of the Kara Sea was certainly free from ice by the beginning of August, and very probably by the middle of July. In August and September, therefore, vessels from Europe could undoubtedly have reached the mouth of the Yenisei."

It is probable the *Eira* took advantage of the disappearance of the ice in August, as mentioned above, to make her way to Franz Josef Land.

Lieutenant Berry, of the *Rodgers*, found the sea becoming deeper as he sailed to the north-eastward from Wrangell Island. His observations off Herald Island indicate that there is no regular current flowing to the north-west, as previously supposed. No perceptible current was noticed at low and high water—the only movement being caused by the tidal action.

The expedition sent out by the Danish Government last summer to Greenland, has returned home. It proceeded to the southernmost part of Greenland and succeeded in circumnavigating the large islands on the southern coast and in determining the exact position of Cape Farewell. Investigations were conducted on the mainland from the Tasermint Fjord on the west coast to the Lindenows Fjord on the east coast.

There are high mountains and enormous glaciers on the west side. The eastern section is of lower elevation, and covered with

a layer of ice and snow with the exception of a few mountain peaks.

Mr. Dall, in an elaborate paper on the hydrology of Behring Sea, in *Petermann's Mittheilungen*, concludes that the warm surface water which enters the Polar Sea through Behring Strait is, at most, capable of melting 5100 square inches of ice, and that its influence is consequently insignificant. No branch of the Kuro Siwo enters the Behring Sea, and the currents in the Polar basin to the north of it, are mainly dependent upon the winds. There is no reason to suppose that these drift currents are capable of opening passages through the pack-ice which would enable exploring vessels to reach the Pole or even a very high latitude.

The British Government are considering a plan for the establishment of a meteorological station at Fort Simpson, on the Mackenzie River, to be conducted on the system adopted by the International Polar Conference.

Lake Onega may be considered to mark the natural boundary between Northern Russia and Finland, as regards their geological structure, topographical features, fauna and flora.

MICROSCOPY.[1]

THE ACME MICROSCOPES.—These really excellent instruments, combining good workmanship with moderate cost, and built upon a model which comprises many of the most convenient and serviceable of recent improvements in the construction of stands, have passed into the hands of James W. Queen & Co., of Philadelphia, who will act as business agents for their sale, and whose great business facilities cannot fail to secure for them a more general and adequate appreciation and attention than they have yet received. A "No. 4" stand, simpler and smaller than those formerly made, and a "lithological," specially adapted to the examination of rocks, are among the recent additions to the Acme series.

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SCIENTIFIC NEWS.

— A French naval doctor, M. Crevaux, has lately made important explorations in the northern parts of South America, more especially in the valley of the Orinoco and its affluents. Among other facts of observation, he states that the Guaraunos, at the delta of that river, take refuge in the trees when the delta is inundated. There they make a sort of dwelling with branches and clay. The women light, on a small piece of floor, the fire needed for cooking, and the traveler on the river by night often sees with surprise long rows of flames at a considerable height in the air. The Guaraunos dispose of their dead by hanging them

[1] This department is edited by Dr. R. H. WARD, Troy, N. Y.

in hammocks in the tops of trees. Dr. Crevaux, in the course of his travels, met with geophagous, or earth-eating tribes. The clay, which often serves for their food whole months, seems to be a mixture of oxide of iron and some organic substances. They have recourse to it more especially in times of scarcity; but, strange to say, there are eager gourmands for the substance, individuals in whom the depraved taste becomes so pronounced, that they may be seen tearing pieces of ferruginous clay from huts made of it, and putting them in their mouths.

— Wasps are such an obstacle in the way of English fruit growers that one of them, Mr. William Taylor, thinks it worth while to pay three pence each for queens. And this season he bought and destroyed no less than 1192; about 230 nests have been annihilated within a mile of his premises, and still there is enough left for seed. He declares that the price named is not too high, "since it takes considerable skill to catch them," and because of their enormous fecundity, of which he says in the *Cottage Gardener:* "Understand that every wasp seen before the middle of June is a queen, and liable to have a nest of 10,000 at least. I lately estimated the number of cells in a rather large nest, and made out 9000 of them. A great many of the young had flown, and fresh eggs were laid in their places, and I have reason to believe that there is often more than one succession of young insects from the same cells, therefore 10,000 is a comparatively small family."

— It has been found by M. de Lacerda that permanganate of potash is very efficacious as an antidote to the poison of snakes. He experimented on dogs, injecting a one per cent. solution of the substance into the cellular tissue or into the veins, after the poison, and the usual effects of the latter were strikingly obviated. In one series of experiments the poison was allowed time to take some effect before the permanganate solution was injected, the dogs showing dilatation of the pupil, respiratory and cardiac derangements, muscular contractions, &c. Two or three minutes after the antidote was given these troubles disappeared, and after 15 to 25 minutes of some measure of prostration, the animal would be able to walk and even run about, and recover its normal aspect. The same dose of poison, not counteracted, caused death, more or less rapidly.

—Mr. J. M. Swanks' Statistics of the Iron and Steel Productions of the United States, 1881, is issued by the Census Bureau, and bears the marks of careful preparation. The historical sketch is interesting reading. The statement is made that "we are to-day the second iron-making and steel-making country in the world. In a little while we shall surpass even Great Britain in the production of steel of all kinds, as we have already surpassed her in the production of Bessemer steel and in the consumption of all iron and steel products. The year 1882 will probably witness this con-

summation. We are destined also to pass Great Britain in the production of pig iron.

—Under the title of "Zoölogy in the University of Tokio,". Professor C. O. Whitman, late professor of zoölogy in the University of Tokio, discourses in a pamphlet of forty-four pages on the needs of a more complete endowment of a zoölogical department, and the natural advantages enjoyed by the Japanese zoölogist for the study of this science. It contains interesting facts regarding the land leech, the land planarian, the jumping fish, and other animals. Professor Whitman is at present in Naples, studying at the Zoölogical Laboratory, founded by Dr. Dohrn.

—In the Iowa Legislature, on the 20th of January last, a petition from the citizens of Pottawatomie county, and another by Messrs. Henderson and Calkins, were presented, asking for a thorough geological survey of the State. Both petitions were referred to the Committee of Ways and Means, which reported favorably on the project. Another move has been made looking toward the establishment of a Bureau of Agriculture, which shall sustain an entomologist, an office which is sadly needed.

—Queen, one of the group of elephants connected with Barnum's circus, at Bridgeport, Conn., gave birth to a baby elephant last night (February 3) at eight o'clock; weight, forty-five pounds. The other baby elephant weighed one hundred and twenty-six pounds at birth. At last reports mother and daughter were doing well.

— M. Pasteur has resolved to continue his researches into the means of preventing diseases by destroying or nullifying the virulence of the germs, and is about to visit the Bordeaux lazaretto, with a view of studying yellow fever, which he hopes to conquer by means of inoculation.

—A new and most valuable feature of the Census Reports for 1880 are the Forestry Bulletins, prepared by Mr. C. S. Sargent. Each number is accompanied by a map of some State, showing the distribution of forests, with special reference to the lumber industry.

—*Humboldt* is the title of a new monthly illustrated magazine of science in all departments, published at Stuttgart and edited by Dr. G. Krebs.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Boston Society of Natural History, Jan. 18, 1882.—Mr. Wm. M. Davis discussed the classification of Lake Basins, and Mr. F. W. Putnam spoke of the use of copper and bronze by the early races of America.

Feb. 1.—Professor Henry W. Haynes gave some indications of an early race of men in New England, and Mr. F. W. Putnam showed some interesting stone implements from Marshfield, Mass.

Mr. S. W. Garman spoke of a case of bird reasoning (?), and remarked on certain features of interest in the formation of cabinets.

NEW YORK ACADEMY OF SCIENCES, Jan. 9.—Dr. L. Johnson described the parallel drift hills of Western New York, and Professor J. S. Newberry remarked on hypothetical high tides as agents of geological change.

Jan. 30.—The following papers were read: The discovery of emeralds in North Carolina, illustrated with remarkable specimens, by Mr. Wm. Earl Hidden. Mr. George F. Kunz exhibited a series of ancient obsidian knives found near the city of Guatemala, C. A.

Feb. 6.—Professor J. S. Newberry remarked on the origin and relations of the carbon minerals.

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SELECTED ARTICLES IN SCIENTIFIC SERIALS.

AMERICAN JOURNAL OF SCIENCE, February.—The flood of the Connecticut river valley from the melting of the Quaternary glacier, by J. D. Dana. Geology of the diamond, by O. A. Derby. A Cercaria with caudal setæ, by J. W. Fewkes. Notice of a remarkable marine fauna occupying the outer banks off the southern coast of New England, by A. E. Verrill.

QUARTERLY JOURNAL OF MICROSCOPICAL SCIENCE, January.—On the morphology of *Hemileia vastatrix* (the fungus of the coffee disease of Ceylon), by H. M. Ward. On the nature of the organ in adult Teleosteans and Ganoids, which is usually regarded as the head-kidney or pronephros, by F. M. Balfour. Observations on the resting stage of *Chlamydomyxa labyrinthuloides*, by P. Geddes. Review of recent researches in karyokinesis and cell division, by J. T. Cunningham. The micro-organisms which occur in septicæmia, by G. F. Dowdesnell. Pringsheim's researches on chlorophyll, translated and condensed by B. Balfour.

ZEITSCHRIFT FÜR WISSENCHAFTLICHE ZOOLOGIE, December 30.—On the structure of the bird-inhabiting Sarcoptidæ, by G. Haller. On *Scoloplos armiger*, by W. Man. Comparative-embryological studies, by E. Metschnikoff. *Dimorpla nutans*, a connective form between the Flagellata and Helliosa, by A. Gruber. Contributions to a knowledge of Amœbæ, by A. Gruber. Contributions to a knowledge of Radiolarian shells. by O. Bütschli.

ZOOLOGICAL MAGAZINE, January.—Traces of a great post-glacial flood, by H. H. Haworth.

ANNALS AND MAGAZINE OF NATURAL HISTORY, December—.On certain points in the morphology of the Blastoidea, by P. H. Carpenter.